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U. S. DEPARTMENT OF AGRICULTURE.

FOURTH AND FIFTH ANNUAL REPORTS

OF THE

BUREAU OF ANIMAL INDUSTRY

FOR

THE YEARS 1887 AND 1888.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1889.

[PUBLIC RESOLUTION—No. 8.]

Joint resolution authorizing the printing of fifty thousand copies of the Fourth and Fifth Annual Reports of the Bureau of Animal Industry for the years eighteen hundred and eighty-seven and eighteen hundred and eighty-eight.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That there be printed fifty thousand additional copies of the Fourth and Fifth Annual Reports of the Bureau of Animal Industry for the years eighteen hundred eighty-seven and eighteen hundred eighty-eight, of which thirteen thousand copies shall be for the use of the members of the Senate, twenty-seven thousand copies for the use of the House of Representatives, and ten thousand copies for the use of the Secretary of Agriculture, the illustrations to be executed under the supervision of the Public Printer, in accordance with the directions of the Joint Committee on Printing, the work to be subject to the approval of the Secretary of Agriculture; that the reports for the two years be printed and bound in one volume, and there be, and is hereby, appropriated out of any money in the Treasury not otherwise appropriated the sum of thirty-seven thousand nine hundred and thirty dollars, or so much thereof as may be necessary for that purpose.

Approved, March 1, 1889.

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LETTER OF TRANSMITTAL.

SIR: I have the honor to submit herewith the Fourth and Fifth Annual Reports of the Bureau of Animal Industry, covering the work of the years 1887 and 1888, which have been combined for publication in one volume. An account is given therein of the operations of the Bureau for the suppression of the contagious pleuropneumonia of cattle, of the investigations of various diseases of our domestic animals in different parts of the United States, and of information obtained bearing upon the present condition of the animal industry of the country.

The period included in these reports embraces all of the work for the eradication of pleuro-pneumonia which has been done since authority was given for applying such measures as are essential for the success of the work. Thus, during the first six months of the outbreak at Chicago, Ill., there was no authority to purchase and slaughter exposed animals, and an insufficient sum was available for the destruction of those actually diseased. The appropriation act for the year 1887-'88 gave additional authority, however, and from the time it went into effect the work has gone on successfully.

Before the close of the year 1887 this dangerous disease had been eradicated from Illinois, and as soon as this was accomplished the affected districts in the eastern section of the United States were placed in quarantine and a rigid supervision of the cattle traffic was established. Although, as compared with the results of similar work in other countries, the time has been short to demonstrate the effects of the system here adopted, the progress has nevertheless been such as to give the greatest encouragement. The Western States, and all of the interior districts of the Eastern States, have been freed from the contagion. The disease no longer exists in Virginia or Pennsylvania. In Maryland it is confined to Baltimore; in New Jersey it is confined to Hudson County; in New York it is confined to New York City and to Brooklyn and its suburbs. In all of these places infected herds are slaughtered as soon as discovered, and the premises where they have been are thoroughly disinfected. No other States are infected.

The enforcement of proper regulations to prevent the dissemination of the contagion, together with these energetic measures for its suppression, have rapidly narrowed the infected areas and have

greatly lessened the prevalence of the disease in the centers where it has longest existed. There is no longer any doubt that, with a continued application of these measures, the disease will soon disappear entirely from this country.

The amount of work necessary to an efficient supervision of the infected districts has been far greater than was anticipated. Thus, for the eleven months accounted for in the report of 1888, the number of animals inspected reached 305,280, or over 1,000 head per day. And this inspection includes a careful examination of the lungs of each animal. The number of *post-mortem* examinations in the same time was 43,176, or 150 per day. The other parts of the work were of course proportionally heavy. The force has been remarkably efficient, and although it has often been necessary to adopt arbitrary measures, which have been a hardship to the owners of cattle, there have been few complaints.

For several years there has been much discussion among well-informed people in regard to the relation between the number of cattle, particularly those maintained for the production of beef, and the population of the country. There has been a great desire on the part of cattle-raisers to know whether the stock of cattle was increasing or decreasing as compared with the population. It has also been a question of much interest whether the price of cattle is fixed arbitrarily by the few large firms which control the beef trade, or whether prices here as with other commodities result from the operation of the laws of supply and demand. An earnest attempt has been made to answer these questions so far as possible from the information which could be obtained. Much care was devoted to the collection of the data, and it is believed to be reliable.

A section of the report is given to the diagnosis of glanders in horses. There is no more important question for the stock-owners of the United States. Many of our States have laws for the suppression of this disease by the destruction of all affected horses. One of the great obstacles to the enforcement of such laws has been the difficulty of making a reliable diagnosis in the many obscure cases which are encountered. This trouble has been largely overcome by the recent advances made by science in this and other countries. A synopsis of these investigations, together with experiments made by this Bureau in testing the suggested methods of diagnosis, should be of great assistance to all engaged in controlling this dangerous disease.

The investigations made in regard to the communicable diseases of swine are of very great importance towards clearing up the nature and cause of such diseases, and indicating the measures which are to be adopted for their prevention. Two diseases have been described, caused by different germs, having quite different characters. These are often complicated with each other, and were first differentiated

by the investigations made in the Bureau of Animal Industry. The suggestions for preventive treatment which are given are the results of years of careful study of these diseases, and if adopted will do much to lessen their ravages.

Among the more valuable papers contained in this volume are: "The Tape-worm disease of Sheep of the Western Plains," by Dr. Cooper Curtice; the "Condition of the Cattle Interests west of the Mississippi River," by Col. H. M. Taylor; the report on the "Number and Value of Pure-Bred Cattle in the United States," by E. W. Perry, esq.; and the papers prepared to accompany the exhibit of animal products at the Paris Exhibition of 1889.

In conclusion, it affords me pleasure to acknowledge the ability, energy, and devotion to work shown by Dr. Theobald Smith and Dr. F. L. Kilborne in conducting the experimental work, the details of which are given in this report.

Respectfully submitted.

D. E. SALMON,

Chief of the Bureau of Animal Industry.

Hon. J.-M. RUSK,

Secretary of Agriculture.



FOURTH AND FIFTH ANNUAL REPORTS OF THE BUREAU OF ANIMAL INDUSTRY.

REPORT OF THE CHIEF OF THE BUREAU.

The work for extirpating contagious pleuro-pneumonia, and for preventing its spread into uninfected States and Territories, has been the most important business of the Bureau during the years 1887 and 1888. While the work of scientific investigation and the collection of information of value to the agricultural and commercial interests of the country have not been neglected, the urgent necessity for the immediate control of the exotic cattle disease just mentioned has caused by far the greater part of the appropriation to be used for that purpose. This also was in accordance with the evident intention of Congress in increasing the appropriation and in conferring special authority for its use. Beginning, therefore, with this special work, an endeavor will be made to give such information in regard to the operations of the Bureau for the two years as is likely to be of value to persons interested in the animal industry of the country.

PLEURO-PNEUMONIA.

At the time my last report was submitted the contagious pleuro-pneumonia, or European lung plague of cattle, existed not only in the plague spots of the Eastern States, where its presence has been recognized for years, but to an alarming extent in Chicago, one of the greatest live-stock centers of the country. The knowledge that this deadly contagion had fixed itself so far in the interior, where there was so much danger of its being scattered in many directions by the movement of cattle, caused apprehension and alarm among the cattle owners and business men of all the Western States and Territories. The introduction of cattle, not only from Cook County, but from the whole State of Illinois, was prohibited by the State authorities in many instances. Thus there was at once a most serious and widespread interruption of traffic and disturbance of values, in addition to the losses from the disease.

When the outbreak at Chicago was discovered, and for some months afterwards, both national and State laws applicable to its eradication were imperfect. The appropriation for the Bureau of Animal Industry for the year ending June 30, 1887, authorized the purchase of diseased animals whenever it was necessary to prevent the spread of pleuro-pneumonia from one State into another; but as the statute then in force in Illinois required the slaughter of ani-

mals affected with this disease without compensation, it did not appear proper that they should be purchased by the General Government. The work of the Department was therefore confined to an investigation of the extent of the disease and the maintenance of a guard over the infected distillery stables and over one infected farm upon which were found exposed about 250 head of cattle.

The inspection made by the Department veterinarians soon showed that the contagion had been disseminated quite extensively by diseased cattle which had pastured upon the vacant lots and commons about the city, and there mingled with many milch cows which had been allowed to run at large.

The appropriation act approved March 3, 1887, not only increased the sum to be expended by the Bureau of Animal Industry from \$100,000 to \$500,000, but gave authority to purchase both diseased and exposed cattle, and made \$100,000 immediately available. The Chief of the Bureau was at once directed to proceed to Illinois and reach some understanding, if possible, with the governor and live-stock commission, by which the work in that State might be made efficient and the disease eradicated without further delay. At a conference between these gentlemen, held in Springfield, Ill., it was decided that the Department of Agriculture would pay for the diseased and exposed animals that were slaughtered; a veterinarian, not previously stationed there, and having reputation and experience, would be placed in charge of the Department work; the force of the Department would be increased as required for the extermination of the plague; the separate offices previously maintained by the Department and the State commission would be consolidated; the State commission would do everything in its power to secure the rigid enforcement of the State law.

It was evident from the amount of the appropriation for the current year, and the authority accompanying it, that Congress intended not only that measures should be adopted to prevent the spread of pleuro-pneumonia from State to State, but also for the extirpation of the disease wherever it might exist. The rules and regulations previously prepared under section 3 of the act approved May 29, 1884, and already accepted by several States, were not entirely adapted to the most efficient exercise of this enlarged power. Accordingly new rules and regulations, as follows, were at once prepared and certified to the governors of all the States and Territories of the Union:

Rules and regulations of the United States Department of Agriculture for the suppression and extirpation of contagious, infectious, and communicable diseases among the domestic animals of the United States.

[Prepared by the Commissioner of Agriculture.]

In pursuance of an act of Congress entitled "An act for the establishment of a Bureau of Animal Industry to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," approved the 29th day of May, 1884, and of section 3 of said act, the following rules and regulations are hereby prepared and adopted for the speedy and effectual suppression and extirpation of contagious, infectious, and communicable diseases among the domestic animals of the United States:

RULES AND REGULATIONS.

(1) Whenever it shall come to the knowledge of the Chief of the Bureau of Animal Industry of the Department of Agriculture that there exists, or there is good cause to believe there exists, any contagious, infectious, or communicable disease

among domestic animals in any part of the United States, and he believes there is danger of such disease spreading to other States or Territories, he shall at once direct an inspector to make an investigation as to the existence of said disease.

(2) Said inspector shall at once proceed to the locality where said disease is believed to exist and make an examination of the animals said to be affected with disease, and report the result of such examination to the Chief of the Bureau of Animal Industry.

(3) Should the inspector on such investigation find that a contagious, infectious, or communicable disease exists among the animals examined, and especially pleuro-pneumonia, he shall direct the temporary quarantine of said animals, and the herds among which they are, and adopt such sanitary measures as may be necessary to prevent the spread of the disease, and report his action to the Chief of the Bureau.

He will further notify in writing the owner or owners, or person or persons in charge of such animal or animals, of the existence of the contagious disease, and that said animal or animals have been placed in quarantine, and warn him or them from moving said animal or animals under penalty of sections 6 and 7 of the act of Congress approved May 29, 1884.

(4) When the Chief of the Bureau of Animal Industry is satisfied of the existence of any contagious disease among domestic animals in any locality of the United States, and especially of pleuro-pneumonia, and that there is danger of said disease spreading to other States or Territories, he will report the same to the Commissioner of Agriculture, who will quarantine said locality in the mode and manner as provided in Rule 12. He shall cause a thorough examination of all animals of the kind diseased in said locality, and all such animals found diseased he will cause to be slaughtered. He shall establish a quarantine for a period of not less than ninety days of all animals that have come in contact with diseased animals, or have been on premises or in buildings on or in which diseased animals have been, or have been in any way exposed to disease; and shall make and enforce all such sanitary regulations as the exigencies of the case may require. He will cause to be disinfected in such manner as he deems best all sheds, corrals, yards, barns, and buildings in which diseased animals have been, and until such premises and buildings have been so disinfected and declared free from contagion by certificate in writing signed by an inspector of the Bureau of Animal Industry, no animal or animals shall be permitted to go upon or into said premises and buildings. Should, however, any animal or animals be put upon said premises or into said buildings in violation of this rule and regulation, then such animal or animals shall be placed in quarantine for a period of not less than ninety days, and said premises or buildings be again disinfected. Said second disinfection and the quarantine of said animals to be at the expense of the owner of said premises or buildings.

(5) All animals quarantined by order of the Chief of the Bureau of Animal Industry shall have a chain fastened with a numbered lock placed around their horns, or in case of hornless animals placed around their necks; and a record will be kept showing the number of lock placed upon each animal, name and character of animal, and marks of identification, name of owner, locality, and date of quarantine. The Chief of the Bureau, however, may, in his discretion, in place of chaining said animals, cause the animals to be branded in such manner as he may designate, or may place a guard over the same.

(6) All animals quarantined will be deemed and considered as "affected with contagious disease," and any person or persons moving said quarantined animals from the infected district will be prosecuted under sections 6 and 7 of the act of Congress establishing the Bureau of Animal Industry approved May 29, 1884.

(7) Whenever in the judgment of the Chief of the Bureau of Animal Industry it becomes necessary to kill animals that have been exposed to the contagious disease known as pleuro-pneumonia, in order to prevent the spread of said disease from one State or Territory to another, he shall cause the same to be slaughtered.

(8) All animals diseased with pleuro-pneumonia, and all animals exposed to pleuro-pneumonia, that have been condemned to be slaughtered, shall be first appraised as to their value at the time of their condemnation. Said appraisement shall be made in the mode and manner provided for by the law of the State in which they are located, and such compensation on their appraised value will be paid as is provided for by the law of such State. In case such State has no law for the appraisement of the value of animals diseased with pleuro-pneumonia, or that have been exposed to pleuro-pneumonia, or either, then the Chief of the Bureau of Animal Industry shall direct an inspector of the Bureau to convene a board of appraisers to consist of three members, one of whom said inspector shall appoint, one to be appointed by the owner of the animal or animals condemned, and these two will appoint the third; in case the said owner shall neglect or refuse to name an appraiser, then by two appraisers to be appointed by said inspector. This board will appraise the

value of the animals condemned and certify to the same in writing under oath, and the amount so fixed by said board shall be paid to the owner of the animals condemned. Should the owner of the animals condemned be dissatisfied with the appraisalment, he may appeal from said appraisalment to the circuit court of the United States, and the amount found by said court to be the value of the condemned animals will be paid to the owner.

(9) Whenever it is deemed necessary by the Chief of the Bureau of Animal Industry to supervise and inspect any of the lines of transportation operating in the United States, that do business in and through more than one State, or connect with lines doing business in and through other States, and the boats, cars, and stock-yards in connection with the same, he shall designate suitable inspectors for that purpose, and make all necessary regulations for the quarantine and disinfection of all stock-yards, cars, boats, and other vehicles of transportation in which have been, or in which have been transported animals affected with a contagious disease or suspected to have been affected with such a disease. Such cars and other vehicles of transportation declared in quarantine shall not be again used to transport, store, or shelter animals or merchandise until certified to be free of contagion by a certificate signed by the inspector supervising their disinfection, and such stock-yards shall not again have animals placed in them until likewise declared free of contagion.

(10) All quarantined stock, premises, and buildings will be under the charge and supervision of an inspector of the Bureau of Animal Industry, and shall be in no case free from quarantine until so ordered by the Chief of the Bureau.

(11) Whenever any inspector of the Bureau of Animal Industry is prevented or obstructed, or interfered with in the discharge of his duty in the examining of animals suspected to have a contagious disease, or in placing under quarantine animals or premises, or in disinfecting them, he will report the same to the Chief of the Bureau. He will also call upon the sheriff or other police authorities of the locality where said obstruction or interference occurs for aid and protection in the performance of his duty. Should such sheriff or police authorities neglect or refuse to render such aid and protection he will then apply to the United States marshal of said district for the necessary force and assistance needed to protect him in the carrying out of the duties imposed upon him by these rules and regulations and the provisions of the law by authority of which they are made. He will also file with the United States district attorney information of all the facts connected with such obstruction and interference and the names of the party or parties causing the same.

(12) Should from any cause the Chief of the Bureau of Animal Industry find that it is impossible to enforce these rules and regulations in any State, and that in consequence thereof there is great danger that pleuro-pneumonia will spread from said State to other States and Territories, he will report the same to the Commissioner of Agriculture. Thereupon the Commissioner of Agriculture, if he believes the exigency of the case requires it, will declare said State, in which pleuro-pneumonia exists and in which it is impossible to carry out these rules and regulations, to be quarantined against the exportation of animals of the kind diseased to any other State, Territory, or foreign country. Said order of the Commissioner declaring the quarantine of a State will be published in at least two papers in said State once a week during the existence of said quarantine, and in such other papers as he may select. Notification of the order declaring said quarantine will be certified to the governor of the State quarantined, as well as to the governors of all other States and Territories, and to the agents of all transportation companies doing business in or through said State. All animals of the kind quarantined against in said State will be deemed as animals "affected with contagious disease," and any person moving or transporting any of said animals to any other State or Territory, or delivering any of such animals to any transportation company to be so transported, will be prosecuted under sections 6 and 7 of the act of Congress approved May 29, 1884. Provided, however, that any animal of the kind quarantined against that has been examined by an inspector of the Bureau of Animal Industry and by a certificate in writing signed by such inspector declared to be free from pleuro-pneumonia, may be exported to any other State or Territory, and provided further that said animal shall be exported within forty-eight hours after such examination and signing of said certificate, so that said animal may not be exposed to disease before leaving said State.

(13) Before giving the certificate provided for by Rule 12 the inspector must be furnished with an affidavit made by two reputable and disinterested persons, stating that they have known the animals to be examined for a period of six months immediately prior to the date of examination, and that during that time the animals have not been exposed to pleuro-pneumonia, that they have not been in any of the buildings or on any of the premises, or among any of the herds known to be affected with pleuro-pneumonia, or suspected to be so affected. The inspector may also require further proof as to whether said animals to be examined have been exposed to pleuro-pneumonia.

(14) All rules and regulations heretofore made are hereby revoked, and these rules and regulations will be in full force and effect on and after the 15th day of April, 1887.

NORMAN J. COLMAN,
Commissioner of Agriculture.

These rules were accompanied by a certificate and request for co-operation, of which the following is a copy:

WASHINGTON, D. C., April 15, 1887.

I, Norman J. Colman, Commissioner of Agriculture, do hereby certify to the executive authority of the State of — the foregoing rules and regulations prepared by me for the speedy and effectual suppression and extirpation of contagious diseases among domestic animals of the United States, by virtue of section 3 of an act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and I do hereby invite the executive authority of the State of — to co-operate in the enforcement and execution of said act and of these rules and regulations, made by authority of and in pursuance of the provisions of said act.

Commissioner of Agriculture.

To his excellency, _____,

Governor of the State of —.

The following form of acceptance was inclosed for the signature of the governors accepting the rules and regulations:

_____ 188—.

I, _____, governor of the State of —, and chief executive officer thereof, do hereby acknowledge the receipt of the rules and regulations certified to by the Commissioner of Agriculture of the United States, as having been prepared by him April 15, 1887, in pursuance of the authority of section 3 of an act of Congress approved May 29, 1884, establishing the Bureau of Animal Industry, and further acknowledge the receipt of the invitation to the executive authority of the State of — to co-operate in the enforcement of the provisions of said act, and of said rules and regulations.

And on behalf of the State of —, and by virtue of my authority as the chief executive officer thereof, I do hereby accept the rules and regulations prepared by the Commissioner of Agriculture, April 15, 1887, for the suppression and extirpation of contagious diseases of animals, and agree that the executive authority of the State of — will co-operate with the Bureau of Animal Industry in carrying out the provisions of the act of May 29, 1884, to the full extent of its authority; and that I will direct the sheriffs and other peace officers of the State to render all necessary aid and assistance to the inspectors of the Bureau of Animal Industry in the performance of the duties imposed upon them by the said rules and regulations.

Hon. NORMAN J. COLMAN,

Governor of the State of —.

Commissioner of Agriculture, Washington, D. C.

The governors of thirty-four States and Territories at once accepted these rules and regulations and agreed to co-operate with the Department in the extirpation of pleuro-pneumonia.

At this time, however, very few States had statutes authorizing the governors to accept such rules and regulations, and some of the governors were doubtful of their power to accept without a special authorization from the legislature. There were also many States which had no laws for the suppression of pleuro-pneumonia, or, having such laws, they were too defective for the enforcement of the proper measures to secure the prompt extirpation of the plague.

To overcome this deficiency in State legislation a form of law suited to meet this emergency was suggested to the legislatures then in session. This act was passed by the legislatures of New Hamp-

shire, Massachusetts, Rhode Island, New York, and Virginia, in the following form:

AN ACT to co-operate with the United States in the suppression and extirpation of pleuro-pneumonia.

The people of the State of New York, represented in senate and assembly, do enact as follows: SECTION 1. The governor is hereby authorized to accept, on behalf of the State, the rules and regulations prepared by the Commissioner of Agriculture, under and in pursuance of section three of an act of Congress approved May twenty-nine, eighteen hundred and eighty-four, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and to co-operate with the authorities of the United States in the enforcement of the provisions of said act.

SEC. 2. The inspectors of the Bureau of Animal Industry of the United States shall have the right of inspection, quarantine, and condemnation of animals affected with any contagious, infectious, or communicable disease, or suspected to be so affected, or that have been exposed to any such disease, and for these purposes are hereby authorized and empowered to enter upon any ground or premises. Said inspectors shall have the power to call on sheriffs, constables, and peace officers to assist them in the discharge of their duties in carrying out the provisions of the act of Congress approved May twenty-nine, eighteen hundred and eighty-four, establishing the Bureau of Animal Industry; and it is hereby made the duty of sheriffs, constables, and peace officers to assist said inspectors when so requested; and said inspectors shall have the same powers and protection as peace officers while engaged in the discharge of their duties.

SEC. 3. All expenses of quarantine, condemnation of animals exposed to disease, and the expenses of any and all measures that may be used to suppress and extirpate pleuro-pneumonia shall be paid by the United States, and in no case shall this State be liable for any damages or expenses of any kind under the provisions of this act.

SEC. 4. This act shall take effect immediately.

This act was also passed by the legislature of Illinois with the following penalty clause:

SEC. 4. Any person violating any order of quarantine made under this act, or any regulation prescribed by the Commissioner of Agriculture for the suppression of pleuro-pneumonia, shall be guilty of a misdemeanor, and upon conviction shall be punished by a fine of not less than \$100 nor more than \$1,000, or by imprisonment for not more than six months, or both such fine and imprisonment.

In Maryland this work had been going on very harmoniously and successfully for about eight months under the rules and regulations of August 2, 1886, and the State authorities objected to any material change in the status of co-operation, on the ground that they knew the old rules to be successful in that State, while the new ones might be regarded as more or less of an experiment. Some amendments, which appeared desirable to both parties, were consequently made to the old rules, and these, in the amended form, were then accepted by the governor and live-stock sanitary board on behalf of the State of Maryland, and by the Commissioner of Agriculture on the part of the United States. The following is the text of the amended rules and regulations:

Rules and regulations for co-operation between the United States Department of Agriculture and the authorities of the State of Maryland for the suppression and extirpation of contagious pleuro-pneumonia of cattle.

INSPECTION.

(1) The necessary inspectors will be furnished by the Bureau of Animal Industry of the Department of Agriculture.

(2) The properly-constituted inspectors of the Bureau of Animal Industry who are assigned to this State are to be authorized by proper State authorities to make inspections of cattle under the laws of the State. They are to receive such protection and assistance as would be given to State officers engaged in similar work, and

shall be permitted to examine quarantined herds whenever so directed by the Commissioner of Agriculture or Chief of the Bureau of Animal Industry.

(3) All reports of inspections will be made to the Bureau of Animal Industry, and a copy of these will then be made and forwarded to the proper State authorities; when, however, any inspector discovers a herd infected with contagious pleuro-pneumonia, he will at once report the same to the proper State authorities, as well as to the Bureau of Animal Industry.

(4) The inspectors, while always subject to orders from the Department of Agriculture, will cordially co-operate with State authorities, and will follow instructions received from them, provided they do not conflict with the rules and regulations of the Commissioner of Agriculture and instructions of the Chief of the Bureau of Animal Industry.

QUARANTINE.

(5) When contagious pleuro-pneumonia is discovered in any herd, the owner or person in charge is to be at once notified by the inspector, and the quarantine regulations of the State are to be enforced from that time. The affected animals will be isolated, when possible, from the remainder of the herd, until they can be properly appraised and slaughtered.

(6) To insure a perfect and satisfactory quarantine, a chain fastened with a numbered lock will be placed around the horns, or, with hornless animals, around the neck, and record will be kept showing the number of the lock placed upon each animal in the herd.

(7) The locks and chains will be furnished by the Department of Agriculture, but they will become the property of the State in which they are used, in order that any one tampering with them can be proceeded against legally for injuring or embezzling the property of the State.

(8) Quarantine restrictions once imposed are not to be removed by the State authorities without the consent of the proper officers of the Department of Agriculture.

(9) The period of quarantining will continue at least ninety days after the removal of the last diseased animal from the herd, and will not be removed until the premises have been disinfected. During the whole period of quarantine no animal will be allowed to enter the herd or to leave it, and all animals in the herd will be carefully isolated from other cattle. Any person or persons violating quarantine regulations will be prosecuted under the laws of Maryland by the State authorities.

SLAUGHTER AND COMPENSATION.

(10) All animals affected with or exposed to contagious pleuro-pneumonia are to be slaughtered as soon after their discovery as the necessary arrangements can be made, and the State veterinarian shall, upon the request of the inspector of the Bureau of Animal Industry in charge of the work, make the necessary order for the slaughter of exposed and diseased animals.

(11) When diseased or exposed animals are reported to the State authorities, they shall promptly take such steps as they desire to confirm the diagnosis. The animals are to be appraised according to the provisions of the State law, and the proper officers of the Bureau of Animal Industry (who will be designated by the Commissioner of Agriculture) notified of the appraisement. If this representative of the Bureau of Animal Industry confirms the diagnosis and approves the appraisement, the Department of Agriculture will purchase the animals of the owner and pay for the same.

(12) All slaughter shall be made on the premises where practicable, and the carcasses, blood, and offal of all diseased animals properly buried thereon. In no case shall driving of diseased or exposed animals over the public highway be permitted unless under supervision of an officer of the Bureau. Nor shall such animals be slaughtered at any slaughter-house where adequate provision is not made for the destruction of carcasses, offal, blood, and all infecting matters.

DISINFECTION.

(13) All necessary disinfection will be conducted by the employes of the Bureau of Animal Industry.

INOCULATION.

(14) No inoculation will be permitted.

(15) The salaries and expenses of all the inspectors assigned to Maryland by the Bureau of Animal Industry, the compensation for all animals slaughtered under

their direction, and all other necessary and authorized expenses, shall be paid by the Department of Agriculture.

NORMAN J. COLMAN,
Commissioner of Agriculture.

ANNAPOLIS, MD., July 7, A. D. 1887.

I, Henry Lloyd, governor of Maryland, do hereby approve of the foregoing amended rules and regulations, prepared under direction of Hon. Norman J. Colman, Commissioner of Agriculture, for the suppression and extirpation of contagious diseases of animals, and I agree to co-operate with the Bureau of Animal Industry in carrying out the same in this State.

HENRY LLOYD.

The governor of New Jersey did not formally accept the new rules and regulations, because he considered that he had no authority to do this in the absence of a statute authorizing him to take such action. This work had been for some years under the direction of the State Board of Health, and it was placed in the hands of the officers of the Bureau of Animal Industry to be carried on in accordance with the new rules by the consent both of the governor and of this board.

The appropriation was plainly insufficient to allow of operations at once covering all the infected sections. The policy was, therefore, to first eradicate the plague from the district west of the Alleghany mountains, and from the States of Virginia, Maryland, Pennsylvania, New Jersey, and the interior counties of New York, leaving the expensive work which would evidently be required on Long Island until the last. With some slight modifications this policy was adhered to, and early in 1888 the whole of the infected territory was covered, and since that time the regulations have been enforced as strictly as possible. The general result has been very gratifying, and it has been clearly demonstrated that if the regulations now in force are continued for a sufficient length of time, and if a competent and efficient force is maintained, the disease can be entirely eradicated from the country.

Owing to the apprehension existing as to the danger of pleuropneumonia being disseminated by cars in which diseased cattle had been transported, the following circular in reference to disinfection was prepared and sent to transportation companies, and has been very generally observed:

UNITED STATES DEPARTMENT OF AGRICULTURE,
COMMISSIONER'S OFFICE,
Washington, D. C., May 31, 1887.

To the managers of all railroads and transportation companies in the United States:

Your attention is called to the fact that contagious pleuro-pneumonia exists among cattle in the States of Illinois, Maryland, and New York, and that the infected districts in said States have been duly quarantined by the Department of Agriculture in the manner provided by the act of Congress of May 29, 1884, establishing the Bureau of Animal Industry.

The existence of this contagious disease in such important cattle centers as these States is a danger so menacing to the cattle interests of the United States that it calls for the most prompt, thorough, and energetic measures that can be taken, not only by the National Government, but also by all parties interested in the preservation of the great cattle industry of the country.

No persons or class of persons are more interested in the safety and growth of this industry than transportation companies, who derive a very large proportion of their earnings from the shipment of cattle and their products, and none should be more active and energetic in enforcing such measures as are necessary to stamp out this disease and prevent its possible spread.

The insidious character of this disease, its easy and imperceptible propagation by contact with animals having the germs of disease and giving no outward symptoms

of its presence, the contraction of the plague from infected cars, the spreading of the germs by means of manure carried in uncleansed cars from place to place, all make it a matter of grave concern, and render it necessary that stringent measures should be adopted to protect the cattle interests of the country from this great evil.

I have, therefore, to suggest and to request that all transportation companies shall establish on their respective lines a rule, and see that it is rigidly enforced, that all cars that have carried live stock shall be thoroughly cleansed on the discharging of their freight, and not allowed to leave the freight or stock yards before this is done. Also that the said cars shall be carefully disinfected in the following manner:

- (1) Remove all litter and manure.
- (2) Wash the car with water thoroughly and until clean.
- (3) Saturate the walls and floors with a solution made by dissolving 4 ounces of chloride of lime to each gallon of water. Stock-yards and pens should be cleansed and disinfected at least once a week.

Transportation companies having connections with infected districts should require parties offering cattle for shipment to present, at point of loading, affidavits of the owner and two disinterested persons, stating that the cattle to be shipped have been known to affiants for at least six months next preceding, and that the said cattle have not been in any of said districts and have not come in contact with any cattle from said districts. Said affidavits should be attached to and accompany the way-bill to point of destination.

As several very extensive outbreaks of pleuro-pneumonia have recently been traced to cattle that had been shipped from infected districts a considerable distance by rail, the necessity of these precautions can not be overestimated, and if enforced they would be a material safeguard against the spread of this disease.

Railroad companies can be of the greatest assistance to the Bureau of Animal Industry in its work of extirpating pleuro-pneumonia, if they will co-operate with it and assist in maintaining the rules and regulations prescribed by me on April 15, 1887, and the quarantine orders since made.

I hope this support and assistance will be cordially given.

Very respectfully,

NORMAN J. COLMAN,
Commissioner of Agriculture.

WORK IN ILLINOIS.

On April 20, 1887, Dr. James Law, professor of veterinary medicine and surgery in Cornell University, took charge of the work for the suppression of pleuro-pneumonia in Cook County, Ill., on behalf of the Department of Agriculture, acting in the capacity of chief inspector of the Bureau of Animal Industry for Illinois. From this time the work was pressed vigorously forward. The cost of inspection, of tagging and registering cattle, of maintaining quarantines, of disinfection, of compensation for slaughtered cattle, of clerical work in the office, of office rent, etc., was paid by the Bureau of Animal Industry. The State paid the expenses of the live-stock commission, of the State veterinarian, and of the appraisers.

Cook County was placed in quarantine May 24 by the publication in the newspapers and by sending a notice to the officers of the railroad and transportation companies. These notices were as follows:

UNITED STATES DEPARTMENT OF AGRICULTURE,
COMMISSIONER'S OFFICE,
Washington, D. C., May 24, 1887.

To the managers and agents of all railroad and other transportation companies throughout the United States, and other persons:

Notice is hereby given by publication, in pursuance of section 7 of an act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," that a contagious, infectious, and communicable disease, known as pleuro-pneumonia, exists among cattle in the county of Cook, State of Illinois; that all cattle in said infected district are hereby quarantined until further notice, and deemed cattle "affected with a contagious disease," and all persons are

prohibited from moving or transporting any cattle from said county of Cook, State of Illinois, to any other State or Territory of the United States, under penalty of sections 6 and 7 of the above-entitled act : *Provided, however*, That any cattle that have been examined by an inspector of the Bureau of Animal Industry, and by said inspector are certified to in writing as being free of pleuro-pneumonia, may be transported to any other State or Territory from said infected district within forty-eight hours after being so certified to : *And provided further*, That said inspector is furnished with an affidavit made by two disinterested persons, stating that they have known said cattle for a period of six months immediately prior to the examination, and that during that time said cattle have not been exposed to pleuro-pneumonia. Said inspector may require further evidence that the cattle have not been exposed, and such proof as he requires must be given him.

The attention of all persons is called to sections 6 and 7 of the act of Congress approved May 29, 1884, establishing the Bureau of Animal Industry, which sections make it a misdemeanor punishable by a fine of not less than \$100 nor more than \$5,000, or by imprisonment for not more than one year, or by both such fine and imprisonment, for any transportation company or person to receive for transportation, or to transport, or to drive, from one State or Territory to another any live stock affected with any contagious, infectious, or communicable disease, and especially pleuro-pneumonia ; or for any person or persons to deliver such affected live stock to any transportation company.

A reward of \$100 will be paid to any person giving information to the Chief of the Bureau of Animal Industry that results in the conviction of any person for a violation of sections 6 and 7 of the act of Congress of May 29, 1884.

NORMAN J. COLMAN,
Commissioner of Agriculture.

UNITED STATES DEPARTMENT OF AGRICULTURE,
COMMISSIONER'S OFFICE,
Washington, D. C., May 24, 1887.

To the agents of ——— ——— :

You will take notice that, in pursuance of section 7 of an act of Congress approved May 29, 1884, establishing the Bureau of Animal Industry, you are hereby notified that a contagious disease, known as pleuro-pneumonia, exists among cattle in the county of Cook, State of Illinois, in and through which infected district your company is doing business. Said district is hereby declared in quarantine until further notice, and you are hereby directed not to receive for transportation, nor to transport, any cattle from said county, in said State, to any other State or Territory, unless such cattle have first been examined and inspected by an inspector of the United States Bureau of Animal Industry, and said inspector gives a certificate in writing that the cattle examined are free from the contagious disease known as pleuro-pneumonia, and have not been exposed to such disease, in which case said cattle so certified to may be transported from said district within forty-eight hours from the time of examination, and not otherwise. Before examining cattle to certify for transportation the inspector must be furnished with an affidavit, made by two disinterested persons, stating that they have known the cattle for a period of six months just prior to the examination, and that such cattle have not been exposed to pleuro-pneumonia ; that they have not been in any of the buildings, or on any of the premises, or among any of the herds that have been specially quarantined in said district. The inspector may require other proof that the cattle have not been exposed to pleuro-pneumonia, which must be furnished before he gives the certificate.

Provided, however, until further notice, that cattle offered for shipment from the Union Stock Yards at the city of Chicago, Cook County, Ill., may be received and transported without examination and without the certificate above prescribed. Nothing, however, in this proviso to exempt parties making such shipment from the penalty for shipping or offering for shipment cattle affected with pleuro-pneumonia, or cattle from said Cook County, Ill.

Your attention is directed to sections 6 and 7 of the act of Congress approved May 29, 1884, establishing the Bureau of Animal Industry, which sections make it a misdemeanor, punishable by a fine of not less than \$100 nor more than \$5,000, or by imprisonment for not more than one year, or by both such fine and imprisonment, for any railroad company to receive for transportation, or to transport from one State or Territory to another, any live stock affected with any contagious, infectious, or communicable disease, and especially with the disease commonly known as

pleuro-pneumonia, or for any person or persons to deliver such affected live stock to any transportation company.

Your attention is also called to the rules and regulations prepared by the Commissioner of Agriculture, by virtue of the authority conferred upon him by section 3 of the aforementioned act, and especially to the sixth, ninth, and twelfth rules, a copy of said rules and regulations being herein inclosed.

NORMAN J. COLMAN,
Commissioner of Agriculture.

It will be seen that there was a special exception in regard to the Union Stock Yards. There was no evidence that these yards had ever been infected. An agreement was made with the managers that no cattle were to be received from Cook County, and a guard was also established to make certain that this agreement was carried out. Under these conditions it appeared perfectly safe to allow the traffic and interstate commerce passing through these yards to go on without molestation.

Under the same date similar notices were made in reference to Westchester, New York, Kings, Queens, Suffolk, and Richmond Counties in the State of New York; and Baltimore, Howard, Carroll, and Prince George's Counties in the State of Maryland.

To return to the work in Illinois: Beginning with April 20, every bovine animal in the infected district was numbered by a metal tag placed in the ear; this number was so recorded that by means of a double index the animal could be easily located either by knowing the number or the owner's name. *Post-mortem* examinations were made of all cattle from this district which were slaughtered or which died from natural causes. In this way nearly every herd affected was soon located. As no animals in this district could be moved without a permit, there was no serious difficulty in carrying out these regulations. In addition to this, every herd in which the disease was found, and every herd which was known to have been exposed to it, were slaughtered in the presence of our inspectors.

Every stable in which a diseased or suspicious animal was found was disinfected in the most complete manner by a special corps of men organized and instructed for this work.

As a result of these thorough measures the extension of the plague was soon checked, the last acute case being found on July 28, 1887. There were, however, a considerable number of chronic cases found after that time, and the object of the continued supervision was to discover and slaughter all of these as the only sure precaution against a new outbreak of the trouble.

It was the intention to remove all quarantine restrictions in Illinois by January 1, 1888, but the frequent discovery of lesions in the lungs of slaughtered cows which, while not pathognomonic of pleuro-pneumonia, might have been produced by it, led to the postponement of this action. On December 29 an undoubted case of chronic pleuro-pneumonia, with encysted lung tissue, was discovered. From an inquiry which I at once made as to how this case could have escaped the general slaughter of exposed cattle that I supposed had been completed, I learned that about 300 cows in the infected district had been allowed to remain, on the belief that they had not been exposed. It was one of these animals, slaughtered by the desire of the owner, in the presence of one of our inspectors, which revealed the existence of disease. The remainder of the herd was at once slaughtered and the stable thoroughly disinfected. The quarantine restrictions were consequently extended until April 1, and in the meantime the remainder

of the cattle that were in this district at the time the malady prevailed were slaughtered, and in this way a further extension of the quarantine was prevented.

From January 1 to December 31, 1887, inclusive, 7,411 herds and premises were inspected in Cook County, Ill., containing 24,059 head of cattle. *Post-mortem* examinations were made on 7,267 animals, which were either slaughtered or had died from disease, and among these 350 were found affected with pleuro-pneumonia. The total number of cattle slaughtered in Illinois during this time, for which compensation was made by the Department, was 1,042. Of these, 172 were diseased, and the owners received for them \$3,179.53, an average of \$18.42 for each animal, and 870 were exposed and the owners were paid for them \$14,153.21, an average of \$16.27. The average compensation for the exposed animals is less than for the diseased, for the reason that the value of the carcass was paid by the butcher to the owner, and this amount was deducted from the appraisement, and the owner was paid the difference as compensation from this Department.

There were disinfected in Cook County during the year 677 stables. Some of these were very large, and the work required the constant labor of the disinfecting corps of eight men. The method of disinfecting was to first thoroughly clean the buildings, removing all litter, manure, loose earth, and rotten wood, and then to cover with a mixture of chloride of lime and whitewash. This was applied by means of a powerful force-pump, worked by the members of the disinfecting corps.

The total expenses in Illinois on account of this outbreak, from about September 1, 1886, to December 31, 1887, were \$73,991.96. Of this sum, \$17,332.74 was paid as compensation for slaughtered cattle. Miscellaneous expenses, including disinfecting material and apparatus, tags, and ringers for inserting the same, record books, office rent, etc., amount to \$3,952.52. Traveling expenses of inspectors and other employes, a part of which was for investigating reported outbreaks of disease in the country for a considerable distance around Chicago, amounted to \$3,598.99. The remainder was paid for the services of the inspectors, deputy sheriffs, disinfecting corps, and for clerical assistance in the office, amounting to \$49,107.71. The amount paid for cattle was to all other expenses as 1 to 3.3.

The large proportional expenses for salaries is due to the fact that from October 1, 1886, to April 20, 1887, no cattle were paid for by the Department, but a large force was kept in the field investigating as to the prevalence of pleuro-pneumonia about Chicago, the size of the district that was infected, in guarding infected stables, and in serving quarantine notices for the State authorities. As the State appropriation was acknowledged on all sides to be too small to cope with the emergency, the Department of Agriculture assumed all of the expense which it could in order that the State funds might be used for the slaughter of cattle.

Between 2,000 and 3,000 head of cattle in the distillery stables and on the Harvey farm were quarantined by the State authorities at a nominal cost, and the animals were slaughtered by the State before the Bureau of Animal Industry was given authority to expend money for this purpose. Neither this quarantine, therefore, nor the compensation for the animals appear in this report, and yet the quarantine was maintained for sixty days by guards paid by the Bureau at an expense of about \$100 a day. Of course, cattle when in large

herds can be quarantined and slaughtered at relatively small expense for salaries, but when in small lots and scattered over a large territory, or when a constant guard must be maintained, this expense is greatly increased.

Again, after the slaughter of exposed cattle was suspended, there was a period of watching and investigation to make sure that every vestige of the disease had been destroyed. The period during which the active slaughter of cattle was in progress, and the compensation paid by the Department, was but little over six months, while the total period during which it had been necessary to keep a force in the field was fifteen months. Finally, the expenses for disinfection were very heavy, and this is the only outbreak in which any systematic and thorough disinfection had been practiced in the United States by the authorities up to the time the disease was eradicated. If these facts are taken into consideration, they will explain the preponderance of salaries and other expenses over the amount paid for slaughtered cattle.

There were slaughtered after January 1, 1888, 4 affected cattle, at a cost of \$81.27, an average of \$20.32 per head. There were also slaughtered 129 exposed animals, at a cost of \$2,408.43, an average of \$18.67 per head. The total expenses in Illinois after January 1, 1888, were \$5,946.69, of which \$2,489.70 was paid for diseased and exposed cattle.

The prompt eradication of pleuro-pneumonia from Chicago and vicinity is worthy of more than a simple narration of the fact. It may well be considered one of the most important results ever accomplished by the Department of Agriculture. History gives few if any cases where the dairies of a city of the size of Chicago have once been infected with pleuro-pneumonia and where the disease has been eradicated without years of constant work and the expenditure of vast sums of money. Paris was infected more than one hundred years ago, and, in spite of the large number of veterinarians in that district, and of the stringent laws and regulations promulgated for its suppression, the disease still exists, and its ravages continue from year to year apparently undiminished.

A continued existence of the disease at Chicago would certainly have led to the infection of the whole country within a few years, and the ruin of a profitable cattle industry in the United States. Already the local restrictions placed by the authorities of many States upon the introduction of cattle from Cook County, and in many cases from the whole State of Illinois, had become extremely embarrassing to shippers and burdensome to the whole stock interest of the West. How these restrictions would have been increased by the spread of the plague to other States, and how we should have suffered from a leading article of food, impaired in quality and diminished in quantity, can be easily imagined. By a fortunate combination of circumstances it was possible to check the extension of the plague at once, and to extirpate it within a few months, but the risk of failure and the danger to the country have never been appreciated except by a few who were acquainted with all the facts.

With the publication of the notice giving information of the eradication of the disease and removing the quarantine restrictions which had been imposed by this Department, confidence was restored to the stock-owners of the country, the irksome local restrictions were one by one removed, and soon the freedom of cattle commerce was again established.

No information has since been obtained which would lead to the conclusion that the contagion of pleuro-pneumonia exists in any part of the country west of the Alleghany Mountains. There is, consequently, good reason to believe that it is now confined to the Atlantic sea-board, and with every month that elapses without hearing from it elsewhere this conclusion is strengthened. With the quarantine restrictions now in force in the infected districts there is but little danger of the plague again finding its way to the West, and with the continual repression and diminution of it at all points this danger, small as it is, is constantly becoming less.

During the whole period required for the eradication of pleuro-pneumonia from Chicago and vicinity, being from October, 1886, to April, 1888, inclusive, it was found necessary to slaughter and pay for 176 affected and 999 exposed cattle. The total disbursements were as follows: For salaries, \$52,170.31; for traveling expenses, \$3,819.29; for miscellaneous expenses, \$4,126.61; for affected cattle, \$3,260.80; for exposed cattle, \$16,561.64. The entire disbursements amounted to \$79,938.65.

WORK IN MARYLAND.

Baltimore County, Md., has long been acknowledged to be one of the worst infected localities in the United States. At the beginning of the work, the plague was very prevalent there, affecting nearly every herd in Baltimore and vicinity and extending for a considerable distance into the country. The contagion had existed in the stables and pastures there for so long a time that they were saturated with it, and in many cases it was extremely difficult to secure their thorough disinfection. The work there has, consequently, been as difficult as it is possible for such work to be. Pleuro-pneumonia was also found to exist in the counties of Anne Arundel, Carroll, Howard, and Prince George's, in the same State. The affected herds in all these counties, with the exception of Baltimore, were immediately slaughtered, and the plague was at once eradicated.

In city districts it is much more difficult to discover affected herds. The owners are often ignorant, with no knowledge of the law, or having such knowledge they conceal the disease. It is therefore only by constant watching and thorough supervision of the movement of animals that the diseased herds are discovered. Until November 10, 1887, the State live-stock sanitary board were unwilling to quarantine all herds in Baltimore and require that no cattle should be moved from one premises to another or allowed upon any vacant lot or highway without a permit. Their reasons for not making such an order were, first, that they thought the disease could be eradicated without these stringent regulations; and, secondly, they doubted their ability to enforce it.

An order was issued, however, which took effect November 10, quarantining all bovine animals within 6 miles of the city hall of Baltimore, and prohibiting any movement of cattle within this district without a permit. The order is as follows:

SPECIAL QUARANTINE REGULATIONS.

Whereas the disease known as contagious pleuro-pneumonia now exists as an epizootic among cattle in the city of Baltimore and portions of the county of Baltimore, in the State of Maryland:

Therefore, in order to prevent the further spread of said contagion, I, Robert Ward, chief veterinary inspector of Maryland, and the State live-stock sanitary board, by

virtue of the powers conferred on us by the act of the general assembly of Maryland passed at the January session, 1884, chapter 157, as amended by the act of 1886, chapter 80, do hereby place in quarantine all premises and animals within a radius of 6 miles from the city hall, in Baltimore City, and give notice:

(1) That all persons are prohibited from moving, within the territory aforesaid, from one premises to another, or over any public highway, or unfenced lot or piece of ground, or from bringing into or taking from said territory any animal or animals of the bovine species, except upon obtaining a special permit signed by the chief veterinary inspector for Maryland. All persons are hereby prohibited from driving any animal or animals of the bovine species out of or into the territory aforesaid, except upon obtaining a special permit as above provided. No restrictions, however, are placed upon the movement of bovine animals by rail passing through the county of Baltimore, nor upon steers shipped to either of the stock-yards and intended for immediate slaughter.

(2) The grazing or exposure of animals of the bovine species upon any street, road, lane, or alley, or upon any unfenced lot or piece of ground in the territory aforesaid, is strictly prohibited.

These regulations to take effect on and after the 10th day of November, A. D. 1887.

All sheriffs, deputy sheriffs, constables, and policemen are requested to assist in the enforcement of these regulations.

Done this 24th day of October, A. D. 1887.

ROBERT WARD,
Chief Veterinary Inspector of Maryland.

By order of STATE LIVE-STOCK SANITARY BOARD:

T. ALEX. SETH, *Secretary.*

NOTICE TO CATTLEMEN AND DEALERS.

The following additions to the special quarantine regulations of October 24, 1887, are hereby promulgated and made part thereof, by virtue of the powers therein referred to:

(1) By agreement with the State weigher, the four yards at the northwest corner of the State scales pens are set apart for the exclusive use of local cattle intended for immediate slaughter. Cattle for sale for immediate slaughter will be admitted by permit to these pens, and can be taken by permit direct to the place of slaughter. These yards must be entered by Garrison Road (Butcher's Lane).

(2) No cattle from any portion of the quarantined area, extending 6 miles from the city hall of Baltimore, will be admitted to any other of the State scales pens, nor to the Calverton nor Clairmount stock-yards.

(3) All cattle, from whatever source, that have once entered the above-named four yards for local butcher cattle must be sent direct to slaughter and nowhere else. Cattle from these pens may be weighed on the western set of scales, to which no other cattle except those intended for immediate slaughter will be admitted.

(4) Cattle from the counties of Howard, Carroll, Prince George's, and that part of Baltimore County outside of the specially quarantined area extending 6 miles from Baltimore city hall, may be transported to State scales, or either of the stock-yards, as if from unquarantined districts, provided they are accompanied by the special permit and affidavits required for cattle when going out of the State.

(5) Persons driving cattle from outside counties to the Baltimore market must procure a permit before coming within the 6-mile quarantine limit, otherwise they must go into the four pens above designated for butcher cattle.

(6) All cattle coming by rail from the quarantined district of this State, outside the 6-mile limit, must be unloaded at the Calverton quarantine yards, unless they are accompanied by the special permit, with affidavits, as required above.

(7) The Clairmount stock-yards, the Calverton feeding pens, and that portion of the State scale pens, other than those named above, as reserved for local butcher cattle, must be reserved for the exclusive use of cattle coming by rail from the non-quarantined counties of Maryland and from other States.

Dr. ROBERT WARD,
Chief Veterinary Inspector of Maryland.

Approved:

STATE LIVE-STOCK SANITARY BOARD.

T. ALEX. SETH, *Secretary.*

To butchers and owners of glue factories and rendering works. To all receivers of dead animals.

SIR: To discover each center of lung-plague infection it is necessary that every bovine animal dying within the quarantined district extending 6 miles outward from the city hall should have its lungs examined by a Government inspector.

You are therefore ordered not to receive at your factory or works, or for conveyance thereto, any dead cattle, young or old, unless accompanied by a permit signed by the chief veterinary inspector of Maryland, and to hold such dead cattle without opening them or removing any chain, lock, or tag from the carcass until such inspector is present.

Dr. ROBERT WARD,
Chief Veterinary Inspector of Maryland.

Approved:

STATE LIVE-STOCK SANITARY BOARD,
T. ALEX. SETH, *Secretary.*

NOTICE TO COW DEALERS IN THE BALTIMORE DISTRICT.

All persons dealing in cows or other cattle within the Baltimore quarantined district, extending 6 miles in all directions from the city hall, must reserve their stables for the reception of cattle from outside of said district. Cattle from healthy districts may be moved to the dealers' stables upon procuring the necessary permit, and may then by permit be moved to the stables of the buyer, but they can not again be moved from stable to stable. Cattle dealers wishing to trade fresh cows for fat or dry ones will be granted permits to take such fat or dry cows direct to slaughter, or to the quarantine pens at the State scales, but not to their own stables.

Peddling cows is strictly prohibited.

Dr. ROBERT WARD,
Chief Veterinary Inspector of Maryland.

Approved:

STATE LIVE-STOCK SANITARY BOARD,
T. ALEX. SETH, *Secretary.*

The work of the Bureau in Maryland progressed very satisfactorily under these regulations. The State veterinarian and the live-stock sanitary board have co-operated very cordially in enforcing them, and have done much to secure their efficiency. No bovine animal can be moved from or to any premises in the city of Baltimore without having been inspected by a veterinarian in the employ of the Bureau; every cow that dies in any herd in that city is known to these inspectors and is examined as to the cause of its death; every bovine animal in that district is numbered, and its number and the herd to which it belongs is recorded. It is impossible, therefore, for the disease to exist in a herd for any considerable time before its presence there is detected.

About all of the old infected herds have been destroyed, and the cases which are now found are due to recent infection. Such cases are becoming fewer, and it is believed that this decrease will continue and become more apparent with each month in the future.

From January 1 to December 31, 1887, there were inspected in Maryland 5,704 herds, containing 57,858 head of cattle. *Post-mortem* examinations were made on 2,788 animals, of which 1,137 were found to be affected with pleuro-pneumonia. The total number of stables disinfected was 145. The number of animals affected with pleuro-pneumonia slaughtered in Maryland since July 1, 1886, is 1,442, and of exposed animals (all slaughtered since March 3, 1887), 1,564, making a total of 3,006. The owners received from the Department as compensation for the diseased animals \$33,759.01, an average of \$23.41 per head; for the exposed animals they received \$41,397.71, an average of \$26.46 per head.

The total expenses in Maryland in the work of suppressing pleuro-pneumonia from July 1, 1886, to December 31, 1887, were \$105,883.81. Of this sum \$75,156.72 was paid as compensation for slaughtered cattle. The miscellaneous expenses, including disinfection, locks and chains, tags, record books, etc., were \$1,170.16. Traveling expenses amounted to \$9,430.49. The total amount paid for salaries was only \$20,126.44. The amount paid for cattle was to all other expenses as 1 to 0.41.

We have, with the expenses in Illinois and Maryland, two extremes in the proportion of the amount paid for cattle to that paid for all other purposes. The reason for the large relative expense for salaries in Illinois has been given. The reasons for the small relative expenditures for salaries in Maryland are the large number of affected herds in Baltimore County, which made it easy to find great numbers of affected and exposed cattle; the fact that the work of slaughtering has been continued without intermission, there being no period of investigation covered before the slaughtering began or after it was finished; the small size of the force, which for the most of the time has been insufficient to properly control the movement of cattle. The last reason mentioned was due to the authority given by the State not being sufficient to allow the supervision of the movement of cattle until after November 10, 1887, and, consequently, it would have been a waste of money to increase the force. Since the order of November 10 was made the number of men employed in Maryland has been largely increased, and the relative expenditure for salaries and other expenses will soon be greater than for cattle; but the efficiency of the work has been greatly improved, and the extirpation of the disease will cost less money than if the work were done with a smaller force.

A relatively small expenditure for salaries is therefore no indication either of the efficiency or the economy of the work for the suppression of pleuro-pneumonia. We might have gone on for years in Maryland with twice the expenditure for cattle that was made for all other purposes, but while the prevalence of the plague could have been diminished the contagion could not have been eradicated. To accomplish this result, men must be employed to watch the movement of cattle, and to give permits by which they can be traced, to guard the stock-yards and other cattle markets, and prevent the entrance of diseased animals, to make *post-mortem* examinations on all animals which die or are slaughtered from the infected district, to investigate all reported outbreaks of disease, and to disinfect all premises where the contagion has existed. This system is undoubtedly expensive in the way of salaries, but it is the only way to eradicate the plague, and in the end it is far more economical than any attempt to control the disease with an inadequate force.

Early in 1888 a new law was passed by the Maryland legislature recognizing the work of the Bureau in that State, and providing for co-operation. Although there has been considerable opposition on the part of cow dealers, and in some cases of dairymen, and some violations of the regulations, the supervision has been maintained in an efficient manner and has resulted very satisfactorily.

It has been found difficult, and often impossible, to secure the indictment and vigorous prosecution of parties violating the laws and regulations, apparently because the sympathy of local officers was with the offenders of their district rather than with those who were trying to eradicate this disease. Fortunately the governor and the

attorney-general of the State are interested in the success of the work, and realize its importance; and with their assistance a conviction has recently been obtained which it is believed will have a wholesome effect in preventing further violations, and thus make it unnecessary to continue the prosecutions.

There have been, in 1888, two outbreaks of pleuro-pneumonia in other counties, which were traced to cattle taken there from Baltimore, but in each case the extermination of the disease was promptly secured. At present all herds in the State known to be diseased have been slaughtered, and as but very few new cases have developed during the last sixty days it is believed that the plague is practically eradicated. It will be necessary to continue the supervision for a number of months after the last case has been disposed of before we can conclude that the last traces of the contagion have been destroyed. It so frequently happens that in some obscure country place a person will conceal the disease for months before it is discovered that a long period of watching is required to insure absolute safety.

From January 1 to November 30, 1888, there were inspected in Maryland 9,809 herds, containing 60,312 head of cattle. Of this number 5,055 were re-examined by deputies in addition to the professional inspections, and 17,749 were tagged with numbers and registered upon the books of the Bureau.

There were 74 new herds found affected with pleuro-pneumonia during the year, and these herds contained 1,189 animals, 124 of which were pronounced diseased when the inspection was made. There were purchased for slaughter during the same time 459 affected cattle at a cost of \$12,330.13, an average of \$26.87 per head; also 1,036 exposed cattle at a cost of \$27,087.81, an average of \$26.15 per head.

The high average cost of affected cattle is due to the fact that many of them were but slightly affected, or had so far recovered from the disease that they were as useful to the owner for the production of milk as before the attack. It is also to be remembered that the owner received for the exposed but still healthy animals the sum which was paid by the butcher for the carcasses in addition to the sum given above as paid by the Bureau.

It has been found necessary to disinfect 145 stables, stock-yards, or other premises during the year, and also to make *post-mortem* examinations upon the carcasses of 5,820 bovine animals, of which 507 were found diseased with pleuro-pneumonia.

The total expenses in Maryland from January 1 to November 30, 1888, have been \$99,627.83, of which \$39,417.94 was paid for cattle purchased for slaughter as either diseased or exposed.

WORK IN VIRGINIA.

A thorough inspection was made during the year 1887 in those parts of Virginia where pleuro-pneumonia had been reported in past years. The inspections covered the careful examination of 3,753 head of cattle contained in 353 different herds. The plague was not discovered until December, when it was found to have been recently introduced into a large herd at Hampton. The contagion only spread to a very few animals outside of this herd which had come in contact with it. The infected animals were at once isolated and slaughtered as rapidly as possible. No cases of disease have since appeared there, and we may therefore conclude that it has been eradicated.

The total number of affected cattle purchased in Virginia was 45,

at a cost of \$739, an average of \$16.42 per head. The number of exposed cattle purchased was 53, at a cost of \$641, an average of \$12.10 per head. The total expense caused by this outbreak was \$2,142.73, of which \$1,380 was paid for diseased and exposed cattle.

WORK IN NEW YORK.

During the year 1887 the two interior counties of Washington and Delaware were found to be infected with pleuro-pneumonia, and although the contagion had been introduced into a considerable number of herds it was promptly eradicated. Very much more of the disease has been found in Westchester County than was anticipated, and more work has been done there than elsewhere in the State. Supervision has been maintained, however, in New York and Kings Counties, and a number of diseased herds were slaughtered in each. After the withdrawal of Prof. James Law from Chicago, or about December 1, 1887, he was placed in charge of the work of the Bureau of Animal Industry in the whole State. By orders of the governor of New York it has been possible to maintain quarantines and to establish all necessary regulations for the extirpation of the disease. These orders are as follows:

[Order.]

STATE OF NEW YORK, *Executive Chamber*:

In pursuance of the authority vested in me as governor of the State of New York by chapter 134 of the laws of 1878, entitled "An act in relation to infectious and contagious diseases of animals," I do hereby prescribe the following regulations for the suppression of contagious diseases among domestic animals and the prevention of the spread of the same:

The local boards of health throughout the State shall report to me at once the breaking out of any contagious disease among the domestic animals in their respective districts, and especially of contagious pleuro-pneumonia among cattle. They shall likewise notify at the same time the chief inspector of the Bureau of Animal Industry of the United States at Washington, D. C., of the appearance of contagious pleuro-pneumonia.

When contagious pleuro-pneumonia exists in any portion of the State of New York the Bureau of Animal Industry of the United States will take charge of the work of suppressing the disease and preventing its spread, as provided by chapter 155 of the laws of 1887, entitled "An act to co-operate with the United States in the suppression and extirpation of pleuro-pneumonia."

The inspectors of the said Bureau of Animal Industry shall place in quarantine all animals affected with contagious pleuro-pneumonia or that have been exposed to contagious pleuro-pneumonia, and all premises infected or believed to be infected with the contagion of said disease. All persons are hereby prohibited from moving quarantined animals from the premises where quarantined, and all persons are prohibited from placing on said premises or among said animals quarantined any healthy animals of the kind among which the contagion of said disease exists.

Whenever the chief inspector of Animal Industry finds that contagious pleuro-pneumonia exists among the herds in any county of this State, and believes there is danger of its spreading to other counties, he shall give notice of the existence of said contagion in a county by publication once a week in at least one newspaper published in said county, and warn all persons from moving any animals of the kind diseased to any other county of the State. He shall likewise notify in writing an agent of each transportation company doing business in said county, and warn said company from transporting any animals of the kind diseased from said county to any other county in the State without a permit from an inspector of the Bureau of Animal Industry. All persons are hereby prohibited from driving or transporting by rail or water or vehicle of any kind, or offering for shipment, any animal of the kind diseased from any county in which contagious pleuro-pneumonia is declared to exist by the chief inspector of the Bureau of Animal Industry, in the manner herein provided, to any other county in the State; provided, however, that animals may be transported to other counties when a permit is given therefor by an inspector of the Bureau of Animal Industry.

All railroads doing business in a county infected with contagious pleuro-pneumonia shall cause their stock-yards, pens, and stock-cars to be cleansed and disinfected in such manner as may be directed by an inspector of the Bureau of Animal Industry, and under the supervision of said inspector.

Given at the capitol in the city of Albany, this 10th day of August, in the year of our Lord 1887.

[L. S.]

DAVID B. HILL.

By the governor :

WILLIAM G. RICE,
Private Secretary.

[Order.]

STATE OF NEW YORK, *Executive Chamber :*

In pursuance of the authority vested in me as governor of the State of New York by chapter 134 of the laws of 1878, entitled "An act in relation to infectious and contagious diseases of animals," I do hereby prescribe the following supplemental regulations for the suppression of contagious diseases among domestic animals and the prevention of the spread of the same :

Whenever the chief inspector of the Bureau of Animal Industry shall have given notice as required by executive order of August 10, 1887, of the existence of contagious pleuro-pneumonia, or of the existence of the contagion of that disease, in any county of this State, it shall thereafter be lawful for said chief inspector, in his discretion, to cause all neat cattle in such county to be numbered, tagged, and registered, and all persons are hereby prohibited, after notice given as aforesaid, from moving any such cattle, or allowing any such cattle to stray from any place or premises to any other place or premises, and from allowing any such cattle to be upon any highway or upon any uninclosed land without a permit duly issued and signed by an inspector of the said Bureau, and from and after notice given as aforesaid all persons keeping cattle in any such county are hereby required to give immediate notice to an inspector of the said Bureau of the sickness or death of any cattle belonging to them or in their possession, and also of all births that may occur in their herds and of all other additions thereto, and from and after notice given as aforesaid all persons are hereby prohibited from offering or receiving within any such county any cattle for transportation or removal in any manner whatever, and from transporting any cattle in any manner, whether from any place in such county to another place within the county or to a place out of the county, without a special permit duly issued and signed by an inspector of the said Bureau.

Given at the capitol in the city of Albany, this 8th day of December, in the year of our Lord 1887.

[L. S.]

DAVID B. HILL.

By the governor :

WILLIAM G. RICE,
Private Secretary.

A force was immediately organized in the counties of Westchester, New York, Richmond, Kings, and Queens sufficiently large to tag and register all bovine animals in these counties. The cattle were all quarantined and all movement prohibited unless a permit was first obtained from an inspector of this Department. This system soon worked smoothly, and within a few weeks the whole district was under thorough supervision.

From January 1 to December 31, 1887, there were inspected in New York 1,511 herds of cattle, containing 25,122 animals. *Post-mortem* examinations were made upon 1,347 animals, and of these 447 were found to be affected with pleuro-pneumonia. The total number of animals slaughtered in New York because affected with this disease was 266, and the number slaughtered for exposure was 736, making a total of 1,002 head. The owners received from the Department as compensation for the diseased animals \$6,317.25, an average of \$23.75

per head; and for the exposed animals \$15,577.41, an average of \$21.16 per head.

The total expenses in New York for the suppression of pleuro-pneumonia were, to December 31, 1887, \$30,632.49. Of this sum \$21,894.66 was paid as compensation for slaughtered cattle. The miscellaneous expenses were \$156.95; the salaries, \$6,036.85; the traveling expenses were \$2,544.03. The amount paid for cattle was to all other expenses as 1 to 0.39.

In New York the work has been under substantially the same conditions as in Maryland, with many large herds infected and these easily found, and until recently without any attempt to supervise all movement of cattle within the infected counties. The relation of the different items of expenditure was also very much the same in the two cases.

At the time the report for 1887 was written, a force was being organized to inspect, tag, and register all the cattle and maintain quarantine restrictions in the old infected district of New York, that is, in the counties of Westchester, New York, Richmond, Kings, and Queens. The task was one of great magnitude and has been beset with many unexpected difficulties. In the first test case that came before the courts the governor's proclamation was decided to be invalid, because he had not designated the infected district, but had left it to the Chief of the Bureau of Animal Industry to designate and advertise such districts as might be discovered. The court held that the governor could not delegate this authority.

It was also discovered by the officers of this Bureau that the State law under which the governor's proclamation was issued gave insufficient authority for the necessary regulations, since it did not apply to exposed herds. These facts were laid before the legislature, and, although the session was drawing to a close and it was difficult to obtain action on new subjects, this matter was deemed of such importance that it received favorable consideration, and an amendment was passed which removed the defects in the statutes. Following this, a new proclamation was issued by the governor, and from that time the regulations have been strictly enforced. In some districts it has been necessary to cause many arrests to be made before the people would respect the law, but since they have become convinced that a determined effort is being made to eradicate the disease there has been less occasion for harsh measures.

The progress made in extirpating pleuro-pneumonia from this long-infected district has been very marked. Two of the counties, Westchester and Richmond, have been entirely freed from the contagion. So long a period has elapsed since any cases were discovered in these counties that Governor Hill, on the recommendation of the Chief of the Bureau of Animal Industry, has recently issued an order removing quarantine restrictions.

The complete success of the work over the large territory embraced in these two counties within so short a time is very gratifying, and demonstrates the correctness of the plan adopted.

In the city and county of New York the progress has also been very satisfactory. There are here but a very few herds in which the disease is known to exist, and these are being rapidly disposed of. By far the heaviest work in this county has been done, although it will be necessary, on account of the proportions of the trade and of its being a central market, to keep up a supervision until all parts of the State are free from the contagion.

The disease was found much more prevalent and more generally distributed in Kings and Queens Counties, on Long Island, than elsewhere. Here there has been a continual struggle during the whole year to hold it under control. Much progress has been made and the number of infected herds greatly reduced, but there is still a large amount of work before us.

There has been more disease found during the year than was anticipated at the time the preceding report was written. Partly for this reason, and partly on account of the exhaustion of the appropriation for the year ending June 30, 1888, about six weeks before the end of the year, the results of the year's work have not quite reached our expectations. For nearly two months all active work ceased and the force was reduced to such an extent that only a mere supervision of the movement of cattle could be maintained. This unfortunate relaxation allowed the plague to develop and has increased the total amount of work to be accomplished to a marked degree. Since we now have the whole infected district in charge, the expenditures can be foreseen with sufficient exactness to prevent such an occurrence happening again, unless there should be new outbreaks of greater dimensions than have been discovered in the past.

A recently discovered outbreak is now in progress in Orange County, which is serious in its extent and will require several months for its complete suppression. Our investigations indicated that the contagion was taken there from the city of New York before the quarantine regulations were established, and it has since been concealed by interested parties. The infected district is now believed to be marked out and under control, and there is no reason to doubt the early success of the measures which have been applied. This outbreak will make an unexpected increase of the expenditures, but probably will not delay the work in the old infected districts of the States.

From January 1 to November 30, 1888, there were inspected in New York 12,333 herds, containing 99,726 head of cattle. Of this number 62,184 were re-examined by deputies in addition to the professional inspections, and 100,370 were tagged with numbers and registered upon the books of the Bureau.

There were 323 new herds found affected with pleuro-pneumonia during the year, and these herds contained 4,647 animals, 691 of which were pronounced diseased when the inspection was made. There were purchased for slaughter during the same time 1,576 affected cattle, at a cost of \$40,976.53, an average of \$26 per head; also 3,196 exposed cattle at a cost of \$72,410.50, an average of \$22.65 per head. The smaller cost of the exposed cattle as compared with the affected ones is due to the fact that the amount which the owner realized for the carcasses was deducted from the appraised value, the Department paying the balance.

It has been found necessary to disinfect 1,339 stables, stock-yards, or other premises during the year, and also to make *post-mortem* examinations upon the carcasses of 15,538 bovine animals, of which 2,287 were found diseased with pleuro-pneumonia.

The total expenses in New York from January 1 to November 30, 1888, have been \$250,779.47, of which \$113,387.03 was paid for cattle purchased for slaughter as either diseased or exposed. The remainder constitutes the expense for disinfection, inspection, tagging, registering, supervising the movement of cattle, *post-mortem* examina-

tions, and all the various expenses incident to a work of this character.

In New York there has been a market for the carcasses of exposed animals, and therefore the compensation paid for such animals was less than for the diseased ones. In New Jersey the law is such that it is, as a rule, impracticable to utilize the carcasses of exposed cattle, and hence the average compensation for these has been greater than for the diseased ones. Taking these variable conditions into consideration, it will be observed that the various items of expenditure correspond quite closely in the different States.

WORK IN NEW JERSEY.

The work progressed steadily in New Jersey during the year 1887, and the country districts were cleared from the contagion wherever it was discovered. A more thickly settled district in Hudson County, and particularly Jersey City and vicinity, was known to be extensively infected but could not be freed from the plague owing to the complete lack of quarantine restrictions bearing upon the district as a whole.

From January 1 to December 31, 1887, there were inspected in New Jersey 1,428 herds of cattle, containing 16,461 animals. *Post-mortem* examinations were made on the carcasses of 248 animals, of which 113 were found affected with pleuro-pneumonia. The total number of animals slaughtered in New Jersey because affected with this disease was 94, and the number slaughtered for exposure was 117, making a total of 211. The owners received from the Department as compensation for the diseased animals \$2,275, an average of \$24.20 per head; and for the exposed animals \$3,216, an average of \$27.48 per head.

The total expenses in New Jersey for the suppression of pleuro-pneumonia have been, to December 31, 1887, \$12,146.03. Of this sum \$5,491 was paid as compensation for slaughtered cattle. The miscellaneous expenses were \$199.33; the traveling expenses, \$1,813.43, and the salaries, \$4,642.27. The amount paid for cattle was to all other expenses as 1 to 1.2.

Early in 1888 regulations were perfected by co-operation with the State board of health for quarantining Hudson County, and maintaining complete control of the movement of cattle in that county. A force sufficient for the purpose was organized, and since that time the same regulations have been enforced there as in Maryland and New York. The county, owing to its proximity to New York, and the fact that its milch cows were to a large degree purchased in the New York market, had long been thoroughly infected.

The enforcement of the regulations in New Jersey, as in other States, has been followed by very gratifying results. There have been a number of outbreaks in the interior, but these in all cases have been promptly suppressed. By far the greater part of the work has been performed in Hudson County, which is now, so far as known, the only infected center.

From January 1 to November 30, 1888, there were inspected in New Jersey 8,018 herds, containing 72,095 head of cattle. Of this number 20,413 were re-examined by deputies, in addition to the professional inspections, and 13,318 were tagged with numbers and registered upon the books of the Bureau.

There were 210 new herds found affected with pleuro-pneumonia

during the year, and these herds contained 2,508 animals, 581 of which were pronounced diseased when the inspection was made. There were purchased for slaughter during the same time 502 affected cattle, at a cost of \$12,325.50, an average of \$24.55 per head; also 945 exposed cattle, at a cost of \$25,512.50, an average of \$27.10. The higher average cost of exposed cattle in New Jersey as compared with New York is due to the greater difficulty of disposing of the carcasses of such animals, and the smaller amounts which, for that reason, were realized.

It has been found necessary to disinfect 275 stables, stock-yards, and other premises, and also to make *post-mortem* examinations upon the carcasses of 6,846 bovine animals, of which 514 were found diseased with pleuro-pneumonia.

The total expenses in New Jersey, from January 1 to November 30, 1888, have been \$85,111.60, of which \$37,838 was paid for cattle purchased for slaughter because they were either diseased or had been exposed.

New Jersey is believed to be nearly free from the disease, as but few new herds have been reported during the last sixty days. A large distillery herd is now being slaughtered, and this, with two small diseased herds, constitutes all the infected premises now known in the State. It will, however, be necessary to maintain a force in New Jersey until the plague is eradicated from all parts of New York, or the contagion will be again introduced by the movement of cattle. It is also possible that the disease may be found in the dairies about Newark, but our investigations up to this time have not revealed it.

WORK IN PENNSYLVANIA.

Previous to 1888 the State authorities of Pennsylvania did not accept the rules and regulations of the Department of Agriculture, nor agree to co-operate with the Department for the suppression of pleuro-pneumonia. They, however, expressed a willingness to have the inspectors of the Department make an investigation of alleged outbreaks of the disease, and of its prevalence in any part of the State. Two inspectors were detailed for such investigation in the month of October, 1887, and remained there continuously after that time. They found no herds affected with the plague except such as were known to the State authorities, and but very few of these.

There was much anxiety felt in many parts of the country in regard to the existence of pleuro-pneumonia in Pennsylvania. It would appear from the official information obtained by this Department that the extent of the disease in that State had been greatly overestimated. Unfortunately, the authorities in charge of this work in Pennsylvania had opinions as to the measures necessary to eradicate the disease which were not shared by the authorities of other States, or by the majority of the veterinary profession. They not only practiced inoculation, but they spared those animals which were mildly affected, and after the ordinary period of quarantine allowed them to mingle again with other cattle and to be sent to the markets of that or other States. Such inoculated and convalescent cattle are almost universally regarded as dangerous and capable of communicating the contagion to others for an indefinite period. So much alarm was expressed because of the danger of the plague being

spread by these cattle that the Department offered to purchase and slaughter without cost to the State all exposed animals which the local authorities were unwilling to destroy at State expense. A favorable reply was made to this proposition, and after much correspondence with the special agent of the governor, who has charge of this branch of the service in that State, an agreement adopting a modification of these rules was decided upon. The chief modification of the rules was that no herd should be slaughtered as affected with pleuro-pneumonia until it had been examined and the diagnosis confirmed by the State veterinarian, who should be paid for this service from the appropriation of the Bureau. It was further agreed that the governor would issue a proclamation placing all cattle in quarantine which were on any premises situated within 8 miles of the city hall of Philadelphia.

The proclamation was issued to take effect upon April 9, 1888, and at that time a force of men employed by the Bureau began work inspecting, tagging, and registering all cattle in the specified district. *Post-mortem* examinations were made on all carcasses of cattle which had died and had been taken to rendering works, and of all cows from this district which were slaughtered for food. With these regulations in force it becomes possible to locate the herds affected with pleuro-pneumonia in the vicinity of Philadelphia, and to eradicate the disease. The relations between the State authorities and the officers of the Bureau have been harmonious, and all differences of opinion in regard to diagnosis have been settled by the slaughter and *post-mortem* examination of the affected animals.

From January 1 to November 30, 1888, there were inspected in Pennsylvania 5,291 herds, containing 72,565 head of cattle. Of this number 18,763 were re-examined by deputies, in addition to the professional inspections, and 51,820 were tagged with numbers and registered upon the books of the Bureau.

There were 23 herds found affected with pleuro-pneumonia, and these herds contained 260 animals, 49 of which were pronounced diseased when the inspections were made. There were purchased for slaughter 63 affected cattle, at a cost of \$1,243.50, an average of \$19.73 per head; also 131 exposed cattle at a cost of \$3,167.50, an average of \$24.18 per head.

It was considered advisable to disinfect 117 stables, stock-yards, or other premises; and 13,157 *post-mortem* examinations were made upon the carcasses of bovine animals, of which 72 were found diseased with pleuro-pneumonia.

The total expenses in Pennsylvania from January 1 to November 30, 1888, have been \$37,978.23, of which \$4,411 was paid for cattle purchased for slaughter as either diseased or exposed. The remainder constitutes the expense for disinfection, inspection, tagging, registering, making *post-mortem* examinations, and maintaining that close supervision of all the cattle in the infected district which is absolutely essential for the complete success of the effort for the total eradication of pleuro-pneumonia.

It has been decided that the governor should issue a proclamation removing the quarantine restrictions at Philadelphia, to take effect December 15, 1888, and at that time the greater part of the force stationed there by this Department will be withdrawn. There is every reason to believe that Pennsylvania is now entirely free from this contagion, but it is deemed advisable to maintain a supervision of the cattle in transit through Philadelphia, and also to watch the

rendering works and slaughter-houses for a few months, in order that any re-appearance of it may be promptly detected.

MASSACHUSETTS.

Early in the year 1887 the discovery of cases of acute pleuro-pneumonia was reported from Boston, and the Department was requested by the governor to assist the State board in investigations as to its prevalence and in the enforcement of measures for its eradication. Inspectors were at once sent there, who found that the affected animals had recently been shipped there from Buffalo, N. Y., and it appeared that they had either come to Buffalo from Chicago or had mingled there with cows from Chicago. A thorough inspection and supervision of the dairies about Boston was kept up for several months, and particularly of the herds in which had been introduced those animals which came in the same car with the affected ones. Fortunately but few cases occurred, and it was only found necessary to destroy a very small number of animals.

DISTRICT OF COLUMBIA.

It was known that pleuro-pneumonia existed to a considerable extent in the District of Columbia within the last three or four years, but the inspections and supervision of the inspectors of the Bureau of Animal Industry, together with the activity of the health department, led to its disappearance. To determine definitely as to whether the contagion was still affecting any herds, the Commissioners of the District, at the request of the Commissioner of Agriculture, issued the following order authorizing the Chief of this Bureau to act as veterinarian for the District of Columbia, and empowering the inspectors to make an examination of all cattle in the District:

OFFICE OF THE COMMISSIONERS, DISTRICT OF COLUMBIA,
Washington, July 18, 1887.

ORDERED: The Commissioners having learned that a dangerous communicable disease prevails among domestic animals in the vicinity of the District, which by contagion or transportation may affect the general health and safety, the Commissioners, in pursuance of the provisions of section 8 of the act approved May 29, 1884, order the following measures for the prompt suppression of the same.

1. Upon the recommendation of the Commissioner of Agriculture, the Chief of the Bureau of Animal Industry in the United States Department of Agriculture is hereby authorized and empowered to act as veterinarian for the District of Columbia for the purposes named in the act above quoted.

2. So much of the rules and regulations prepared by the Commissioner of Agriculture in accordance with the requirements of the act aforesaid, and published under date of April 15, 1887, as are applicable to the District of Columbia are hereby approved and adopted by the Commissioners as regulations for the District: *Provided*, That wherever said regulations require report to and action by the Commissioner of Agriculture, the Chief of the Bureau of Animal Industry, acting as veterinarian for the District, shall submit the requisite reports and recommendations for the consideration of and action by the Commissioners of the District of Columbia.

3. The legally appointed agents and inspectors of the Bureau of Animal Industry are hereby empowered, under the direction of the Chief of the Bureau, to discharge corresponding duties for the District of Columbia, and all citizens of the District are hereby directed and required to recognize and respect the said Chief of the Bureau and his duly appointed agents, as lawful officers of the District.

4. The said Chief of the Bureau and his agents are authorized to inspect any premises in the District of Columbia where it is believed there exists any contagious, infectious, or communicable disease among any domestic animals, and if found needful to order the temporary quarantine of said animals, to cause premises to be disinfected, and if necessary to condemn the animals to be killed in order to prevent the spread of disease.

5. The proceedings for the appraisal of the value of animals condemned to be killed shall be had under the provisions of section 8 of the regulations.

6. The Chief of the Bureau aforesaid, acting as veterinarian for the District, shall make to the Commissioners monthly reports of all matters relating to the subject of this order, within the District of Columbia, and, in addition thereto, special reports and recommendations as often as shall be needful, for the information of the Commissioners, to enable them to carry into effect the provisions of the law.

Official copy furnished the Chief of the Bureau of Animal Industry, United States Department of Agriculture.

By order of the Commissioners :

W. TINDALL,
Secretary.

Immediately after the issuance of this order a force of inspectors was placed in the field, and during the year 1887 went over the whole District, examining carefully all the cattle that were found. Their reports show the inspection of 798 herds, containing 3,268 animals, in none of which was pleuro-pneumonia found. As a careful inquiry has also been made in the counties of Maryland which adjoin the District without discovering the plague, it may be safely concluded that this section is now free from it.

THE WORK AS A WHOLE.

To increase the facility of comparison, the following table is given, which shows the work and expenditures for the year 1887:

*Table showing the work of the Bureau of Animal Industry for the suppression of pleuro-pneumonia.**

	Illinois.	Maryland.	New Jersey.	New York.	Total and average.
Herds inspected	7,411	5,704	1,428	1,511	16,054
Cattle inspected	24,059	57,858	16,461	25,122	123,500
Post-mortem examinations	7,287	2,788	248	1,847	11,650
Found diseased on post-mortem	350	1,137	113	447	2,047
Diseased cattle slaughtered with compensation	172	1,442	94	266	1,974
Exposed cattle slaughtered with compensation	870	1,564	117	736	3,287
Total compensation for diseased cattle ..	\$3,179.53	\$33,759.01	\$2,275.00	\$5,317.25	\$45,251.79
Average compensation for diseased cattle ..	\$18.42	\$23.41	\$24.20	\$23.75	\$23.06
Total compensation for exposed cattle ..	\$14,153.21	\$41,397.71	\$3,216.00	\$15,577.41	\$74,344.33
Average compensation for exposed cattle ..	\$16.27	\$26.46	\$27.48	\$21.16	\$22.61
Salary expense	\$49,107.71	\$20,126.44	\$4,642.27	\$6,036.85	\$79,912.27
Traveling expenses	\$3,593.90	\$9,430.49	\$1,813.43	\$2,541.03	\$17,378.85
Miscellaneous	\$3,952.52	\$1,170.16	\$199.33	\$156.95	\$5,478.96
Total	\$73,991.96	\$105,885.81	\$12,146.03	\$30,632.49	\$322,654.29
Ratio between amount paid for cattle and all other expenses	1:3.3	1:0.41	1:1.2	1:0.39	1:0.85

*The slaughter of affected cattle and expenses in Maryland are from July 1, 1886. The salaries, traveling, and miscellaneous expenses in Illinois are from September 1, 1886. All other items are from January 1, 1887, and all are brought up to December 31, 1887.

Including all the districts in which pleuro-pneumonia has existed, there were inspected from January 1 to November 30, 1888, a total of 35,604 herds of cattle, containing 305,280 animals. Of this number 106,415 were re-examined by the non-professional assistants in addition to the veterinary inspections, and 183,257 were tagged with numbers and registered upon the books of the Bureau.

There were 631 new herds found affected with pleuro-pneumonia during the year, and these herds contained 8,643 animals, 1,446 of which were pronounced diseased when the inspections were made. There were purchased for slaughter during the same time 2,649 affected

cattle, at a cost of \$67,695.93, an average of \$25.55 per head; also 5,490 exposed cattle, at a cost of \$131,227.74, an average of \$23.90 per head.

It has been found necessary to disinfect 1,879 stables, stock-yards, or other premises, and also to make *post-mortem* examinations upon the carcasses of 43,176 bovine animals, of which 3,426 were found diseased with pleuro-pneumonia.

The total expenses of the pleuro-pneumonia work from January 1 to November 30, 1888, have been \$481,586.55, of which \$198,923.67 was paid for cattle purchased for slaughter, as either diseased or exposed. The remainder constitutes the expense for inspection, disinfection, tagging, registering, and supervising the movement of cattle, of *post-mortem* examinations, and of all the various expenses necessary to insure the prompt discovery of this plague when it appears in any herd, and to prevent the further extension of the infection.

The following table shows a résumé of the pleuro-pneumonia work from January 1 to November 30, 1888, as given in detail above:

Table showing the work of the Bureau of Animal Industry for the eradication of pleuro-pneumonia from January 1 to November 30, 1888.

	New York.	New Jersey.	Pennsylvania.	Maryland.	Virginia.	Illinois.	Total.
Herds inspected	12,333	8,018	5,291	9,809	13	140	35,604
Cattle inspected	99,726	72,095	72,565	60,312	297	285	305,280
Cattle re-examined by deputies	62,184	20,413	18,763	5,055	.....	.....	106,415
Diseased cattle found by inspection	691	581	49	124	1	.....	1,446
<i>Post-mortem</i> examinations	15,538	6,846	13,157	5,820	103	1,712	43,176
Diseased cattle found by <i>post-mortem</i> examinations	2,287	514	72	507	46	.....	3,426
Cattle tagged	100,370	13,318	51,820	17,749	.....	.....	183,257
New herds found affected	323	210	23	74	1	.....	631
Animals in affected herds	4,647	2,508	260	1,189	39	.....	8,643
Diseased cattle purchased	1,576	502	63	459	45	4	2,649
Exposed cattle purchased	3,196	945	131	1,036	53	129	5,490
Premises disinfected	1,339	275	117	145	2	1	1,879

Résumé of the expenditures in the pleuro-pneumonia work from January 1 to November 30, 1888.

Items.	New York.	New Jersey.	Pennsylvania.	Maryland.	Virginia.	Illinois.	Total.
Salaries	\$109,694.44	\$36,239.05	\$27,886.73	\$46,454.17	\$601.56	\$3,062.60	\$223,938.55
Traveling expenses	17,983.97	8,327.19	3,486.73	11,117.92	141.62	220.30	41,277.73
Miscellaneous expenses	9,714.03	2,707.36	2,193.77	2,637.80	19.55	174.09	17,446.60
Affected cattle	40,976.53	12,325.50	1,243.50	12,330.13	739.00	81.27	67,695.93
Exposed cattle	72,410.50	25,512.50	3,167.50	27,087.81	641.00	2,408.43	131,227.74
Average paid for affected cattle	26.00	24.55	19.73	26.87	16.42	20.32	25.55
Average paid for exposed cattle	22.65	27.10	24.18	26.15	12.10	18.67	23.90

It will be seen from the above that there has been constant and satisfactory progress during the year at all points where the disease exists. The work has been heavy and expensive, and the expenditures for the eleven months covered by the report for 1888 have been greater than the appropriation for any fiscal year. It was only by so planning that the most costly work would come in the latter part of one fiscal year and at the beginning of another that the operations could be sustained in an efficient manner without an increased appropria-

tion. Even with this plan in mind it was necessary to suspend all slaughtering of animals and much of the other work for over six weeks in May and June in order to avoid a deficiency. Although the total expenditures of the first five months of the present fiscal year for the entire work of the Bureau have averaged \$46,178.68 per month, or at the rate of \$554,144.16 per annum, it appears certain that the decrease which has been made, and which can be carried still further as the work proceeds, will bring the total for the year within the sum appropriated, and this without the necessity of interrupting the operations.

We have now entered upon the most critical period in the work for the eradication of this disease. In all of the infected States the animals known to have been diseased or exposed have been slaughtered with few exceptions, but in Maryland, New Jersey, and New York the plague continues to develop at greater or less intervals, and, consequently, newly infected herds are discovered. In Maryland and New Jersey, where the work has been longest in progress, these new infections are becoming less and less frequent. Even in the worst infected districts on Long Island the prevalence of the malady has been greatly diminished. With this decrease in the amount of disease, the reason for the stringent regulations becomes less apparent to the cattle owners, to prosecuting officers, and to citizens generally. It is therefore much more difficult to enforce the laws and the regulations made under them; flagrant violations become more frequent, and in some cases efforts are made, usually by cow dealers, to propagate the disease.

These facts show the importance of maintaining the quarantine restrictions until the last vestige of the contagion has disappeared. And above all should we be able to preserve the interstate channels of commerce free from infection. The large sum of money expended and the encouraging progress of the work, with the rapid approach of the time when the country could be declared free from this plague, emphasize the necessity of adopting every precaution to secure early and complete success. But how is this to be accomplished? Evidently by enforcing every regulation against the spread of the disease until the contagion has entirely disappeared.

I have already mentioned the growing disposition on the part of State officials to relax their regulations, to allow violations to go unpunished, to remove restrictions before safety has been assured. This disposition is alarming, because just as the whole pleuro-pneumonia infection in this country arose from a single case of the disease, so now the escape of one affected animal may undo all that has been accomplished by two years of indefatigable labor and by an expenditure of nearly \$1,000,000.

To guard against this danger, I would respectfully and most earnestly recommend amendments to the act establishing the Bureau of Animal Industry imposing a penalty upon any person who removes or causes to be removed any bovine animal from a section declared by the Secretary of Agriculture to be an infected district to any other State or Territory, or who transports or causes to be transported any such animal upon any railroad or vessel which forms part of a transportation line from one State or Territory into another. At present there is no penalty, except for those who knowingly ship a diseased animal from one State to another. Experience shows that it is impossible to prove that a person knows an animal to be affected. It is also more dangerous to ship exposed animals than affected

ones, because the latter are easily detected as a rule, while the former do not show the symptoms for two or three months, and during this time may scatter the contagion among many animals and herds. It is equally important to prevent the shipment of diseased and exposed animals within a State, except upon lines of railroad and upon steamboats which form a portion of our great interstate commercial channels.

It is worthy of remark that there has been no trouble in enforcing the rules and regulations in country districts where the population is made up of farmers. The native American farmer has always assisted in stamping out the disease and has been scrupulously careful to carry out to the letter any measures that he was called upon to observe. The result is that country outbreaks are soon under control and quickly eradicated. Not so, however, with city outbreaks. Here we come in contact with an entirely different element of our population. The city cow owner, as a rule, is in debt to the dealer from whom he buys his cow. He is poor, ignorant, often unable to speak our language, unscrupulous as to the health of his animals or the character of the milk he sells, and not infrequently appears to consider it his duty to violate the regulations or the statutes rather than to observe them.

In farming districts, therefore, it matters little whether the laws are perfect or imperfect, or whether there are or are not penalties for their violation; it is seldom that they are appealed to, and the work of eradication goes smoothly on until it is completed. In city districts the conditions are exactly opposite. When the inspectors come upon the premises they are met as enemies; too often they are threatened with violence; diseased cattle are surreptitiously sold by the owners, and taken into other herds by dealers whose sales are increased by the misfortunes of their customers. With such people, harsh measures are necessary or the work could never be completed.

The laws should cover all acts which would tend to spread the disease, and there should be penalties applicable to all violations. Without these the time and expense required for complete success must be indefinitely increased.

THE BEEF SUPPLY OF THE UNITED STATES AND CONDITIONS GOVERNING THE PRICE OF CATTLE.

For a long time there has been a desire on the part of those interested in the production of beef cattle to obtain an approximately correct statement in regard to the number of cattle in the country, and the relation of this number to the population for a series of years. The simple estimate of the number of animals from which the beef supply is drawn gives no idea whether this supply is increasing more rapidly than the demand, or whether, on the other hand, it is diminishing. Our rapidly increasing population, and also our fluctuating export trade, must be constantly borne in mind if we expect to obtain any clear views on this important subject.

The great diversity of opinion among well-informed persons as to the relative number of beef cattle, taking the whole country into consideration, shows how meager has been the available information upon this subject. And with this first question unsolved it is evident that the extent and direction of any relative variation which may have occurred could not be estimated. In order to clear up this question somewhat, and to give an idea as to the extent which the price of cattle is governed by the law of supply and demand, an effort has been made during the year 1888 to obtain reliable data as to the number of cattle in the Territories. It is probable that no accurate census of the range cattle has ever been secured, and nearly all of the estimates, on account of the inherent difficulties of the case, have varied widely from the true figures. Accordingly, trusted agents of the Bureau, well acquainted with the range-cattle industry, were sent into the different Territories to gather the most accurate figures possible from the cattle-owners' organizations, and from any other sources of information. In addition to the figures collected in this manner the estimates of the Statistical Division as to the number of cattle in the States in the years since 1880 have been carefully gone over and revised in accordance with later information at our command. The number of range cattle in 1880 is also taken as somewhat less than was estimated in the census. The population since 1880 has been estimated on the basis of 2 per cent. annual increase in addition to the immigration.

Taking our figures from these sources we obtain the following table:

Table showing population, total number of cattle, and number of cattle per 1,000 of population (estimated since 1880) in the United States and Territories.

Years.	Population.	Total cattle.		Years.	Population.	Total cattle.	
		Number.	Per 1,000 of population.			Number.	Per 1,000 of population.
1850	23,191,876	17,778,907	767	1883	55,330,289	42,777,893	773
1860	31,443,321	25,620,019	815	1884	56,955,487	44,800,674	787
1870	38,558,371	23,820,608	618	1885	58,489,943	46,794,256	800
1880	50,155,783	37,008,453	738	1886	59,963,945	47,612,283	794
1881	51,828,330	38,551,471	744	1887	61,683,923	48,308,623	783
1882	53,653,889	40,672,765	758	1888	63,464,501	48,923,880	771

This table shows some interesting facts. At the first approximately accurate census of cattle in 1850 there were 767 cattle to 1,000 of population. This number increased in 1860 to 815, showing a large stock of cattle on hand at that time. In 1870, partly from the effects of the war, and partly from an underestimate of the number of cattle in the country, we find the number of cattle reduced to 618 per 1,000 of population. In 1880 the number per 1,000 increases to the extent of 120 and reaches 738. In 1881 there is an increase of 6 per 1,000; from 1881 to 1882 the increase is 14 per 1,000; from 1882 to 1883 it is 15 per 1,000, being the largest apparent increase in any one year; from 1883 to 1884 the increase is 14 per 1,000; and from 1884 to 1885 it is 13 per 1,000, reaching the highest point since 1860, or 800 cattle per 1,000 population.

Since 1885 there has been a steady decrease in the relative number of cattle. From 1885 to 1886 this was 6 per 1,000; from 1886 to 1887 it was 11 per 1,000, and from 1887 to 1888 it was 12 per 1,000. The total decrease in cattle per 1,000 population from 1885 to 1888 amounted to 29, and the proportion was then as 771 to 1,000.

A somewhat clearer presentation of the beef supply is obtained by separating the milch cows from the other cattle and considering the latter alone. These figures will be found in the table which is given below:

Table showing the total number of milch cows and of other cattle, and the number of each per 1,000 of population.

Years.	Milch cows.		Other cattle.		Years.	Milch cows.		Other cattle.	
	Number.	Per 1,000 of population.	Number.	Per 1,000 of population.		Number.	Per 1,000 of population.	Number.	Per 1,000 of population.
1850	6,385,064	275	11,393,813	491	1883	13,127,267	237	29,650,631	536
1860	8,585,735	273	17,034,284	542	1884	13,502,899	237	31,297,775	550
1870	8,935,332	232	14,885,276	386	1885	13,906,534	238	32,887,722	562
1880	12,443,120	248	24,565,333	490	1886	14,237,827	237	33,374,956	556
1881	12,538,216	242	26,013,255	502	1887	14,524,158	235	33,784,465	548
1882	12,666,031	236	28,005,734	522	1888	14,858,634	234	34,065,246	537

One of the remarkable facts brought out by this table is that since 1870 the proportion of milch cows to population has been practically constant. In 1850 there were 275 per 1,000, and in 1860 273 per 1,000. In 1870 this number decreases to 232, or about 15 per cent., and increases in the ten years from 1870 to 1880 to 248, being at the rate of 1.6 per annum. In the six years from 1882 to 1888 there has only been a variation of 2 per 1,000. The reduction from 275 per 1,000 in 1850 to 234 per 1,000 in 1888, or about 15 per cent., has undoubtedly been more than counterbalanced by improvements in the quality of the stock, so that the quantity of dairy products yielded in proportion to the population is greater instead of being less than in 1850.

Turning our attention now to the "other cattle," from which our beef supply is mostly obtained, we find, in 1850, 491 per 1,000 of population. In 1860 this number increased to 542 per 1,000, or over 10 per cent., and in consequence of the war had dropped by 1870 to 386, a decrease in ten years of 28.7 per cent. In 1880 the number of this class of cattle per 1,000 of population had increased to 490, the

proportion being almost exactly the same as in 1850. From 1880 to 1885 there was a continuous and rapid increase, which was due to the remarkable development of the range cattle industry in that period. Thus, in 1881 there were 502 per 1,000; in 1882 there were 522 per 1,000; in 1883, 536 per 1,000; in 1884, 550 per 1,000, and in 1885, 562 per 1,000. The increase in the five years from 1880 to 1885 was 72 per 1,000 of population, or about 15 per cent.

Since 1885 there has been a perceptible and continuous decrease in the proportion of cattle to population. From 1885 to 1886 this decrease was only 6 per 1,000 of population; from 1886 to 1887 it was 8 per 1,000; and from 1887 to 1888 it was 11 per 1,000. In the three years the decrease amounted to 25 per 1,000 of population, or about 4.4 per cent. of the number given for 1885. The proportion of cattle to population in 1888 was almost exactly the same as in 1883.

In considering the proportion of cattle to population and in drawing conclusions as to the relative beef supply in different years, the fact should not be overlooked that there has been a great change within the last twenty years in the character of steers that have been sent to market. New and better blood has been infused into the old stock, and the result is that steers are marketed younger, weigh more, and yield a larger proportion of carcass than formerly. The beef supply obtained from a given number of cattle is for this reason considerably larger than it was a few years ago. The increased number of cattle per 1,000 of population does not, therefore, represent the whole increase in the beef supply which has taken place since 1870. There is, in addition, an increase resulting from early maturity, size and quality, which can only be estimated with great difficulty and uncertainty.

It is impossible to obtain accurate information as to the number of steers slaughtered annually in this country for beef, or to reach this number by even an approximate estimate. For this reason, the actual beef supply which yearly goes upon the market is an unknown quantity. It becomes necessary, therefore, to judge of the supply by the total stock of cattle on hand in the country. Such deductions are subject at best to grave errors which are liable to arise from a larger proportion of cattle being marketed one year than another, in order to meet temporary financial emergencies, because of lack of feed, or because of a better price for cattle as compared with the price of corn and hay.

The demand for meat for home consumption should be tolerably constant in a series of years like those of the present decade, during which there has been no marked financial depression. There is undoubtedly, however, a considerable influence exerted upon the demand for beef by the quantity and price of pork products. In other words, when the production of pork is abundant and the price low there will be less beef consumed than when these conditions are reversed. The quantity of beef exported must also have an important influence upon the demand and upon the price.

With the facts mentioned above in mind the following table is presented to show the relation between the relative number of cattle in the country and the mean price of steers. It is impossible to give a true average price of steers from the data on hand, but the mean price is a sufficient indication of extent and direction of the fluctuations from year to year:

Table showing the proportion of cattle to population, the value of cattle and beef products exported, and the mean price of beef steers in Chicago.

Years.	Number of cattle (excluding milch cows) per 1,000 of population.	Exports of cattle and beef products.	Mean price of steers in Chicago per 100 pounds.	Years.	Number of cattle (excluding milch cows) per 1,000 of population.	Exports of cattle and beef products.	Mean price of steers in Chicago per 100 pounds.
1878	.....	.....	\$4.25	1884	550	\$36,286,626	\$6.05
1879	.....	.....	4.60	1885	562	32,014,002	5.15
1880	490	\$31,544,360	5.75	1886	556	27,330,390	4.75
1881	502	32,801,705	5.90	1887	548	21,853,718	4.60
1882	522	22,680,272	6.77	1888	537	25,764,994	4.87
1883	536	25,004,746	5.67				

The above table shows that in 1880, with a steady increase in the price of steers since 1878, with 490 cattle (excluding milch cows) to the 1,000 of population, and with an export of cattle and beef products amounting to \$31,544,360, the mean price of butchers' steers in the Chicago market was \$5.75 per 100 pounds. From 1880 to 1881 there was an increase in the number of cattle of 12 per 1,000 of population, the exports increased over \$1,000,000, and the mean price of steers increased 15 cents per 100 pounds. The prices during this year would seem to be consistent with the cattle supply and the exports as indicated in the table.

In 1882 we find a remarkable increase in the price of steers, which can not be explained by the data which has been furnished. With an increase of 20 cattle per 1,000 of population and a falling off in the export trade of over \$10,000,000, the price of cattle not only advanced but reached the very highest point of the decade. The increase of the mean price of steers from 1881 to 1882 was 87 cents per 100 pounds. We will return to this advance later on and endeavor to furnish an explanation of it.

The mean price of steers in 1883 was \$1.10 per 100 pounds lower than in 1882. The exports for the year had increased \$2,500,000, and the number of cattle per 1,000 of population was 14 greater than in the preceding year. Here, again, the fluctuation of price is much greater than the table would lead us to expect. In 1884, with an increase of \$11,500,000 in the exports, and with 14 more cattle per 1,000 of population, the price advanced 42 cents and reached \$6.05 per 100 pounds. In 1885, with the number of cattle per 1,000 of population at the highest point, and with a falling off of \$4,000,000 in exports, the price dropped to \$5.15 per 100 pounds. In 1886 and 1887, with a slight decrease in the relative number of cattle and with a large reduction of exports, the price of steers decreased 35 cents in 1886 and 15 cents in 1887. The export trade revived somewhat in 1888, and the number of cattle in proportion to population continued to decrease; we are not surprised, therefore, to find an advance of 27 cents per 100 pounds in the mean price of beef steers.

Having examined the table given above somewhat critically, we are forced to the conclusion that the fluctuations in the price of steers can not be explained by the simple consideration of the number of cattle in proportion to our population, or by combining this information with the statistics of the export trade. Disturbing conditions which have already been referred to are the average value of

corn, taking the country as a whole, and the price of hogs. To illustrate the influence of these conditions the following table is added :

Table showing the average price of corn in the whole country and the mean price of hogs and beef steers in Chicago.

Years.	Average price of corn, per bushel.	Mean price of hogs in Chicago, per 100 pounds.	Mean price of steers in Chicago, per 100 pounds.	Years.	Average price of corn, per bushel.	Mean price of hogs in Chicago, per 100 pounds.	Mean price of steers in Chicago, per 100 pounds.
	<i>Cents.</i>				<i>Cents.</i>		
1879	37.5	\$3.52	\$4.60	1884	35.7	\$5.75	\$6.05
1880	39.6	5.05	5.75	1885	32.8	4.12	5.15
1881	63.6	5.95	5.90	1886	36.6	4.25	4.75
1882	48.4	7.32	6.77	1887	44.4	4.88	4.60
1883	42.4	6.07	5.67	1888	34.1	5.82	4.87

It will be noticed from this table that, as a rule, the mean price of hogs has fluctuated in the same direction as the average price of corn, but not always in the same proportion. There are some apparent exceptions to this rule; for instance, in 1882 the price of corn is given as much lower than in 1881 and the price of hogs as much higher. The same apparent contradiction is noticed in the years 1887 and 1888. A partial explanation of these exceptions to the rule will be found in the fact that the price given refers to the crop produced in the year named and not the average price of corn for the year. Thus the hogs marketed in 1882 were fed partly upon the crop of 1881 and partly upon that of 1882, so that we should come much nearer the average price of the corn fed to the hogs sold in 1882 by averaging the price for the two years.

By constructing a table on this basis we will see that the apparent exception of 1882 disappears, while that of 1888 is less marked:

Average price of corn.		Mean price of hogs.		Average price of corn.		Mean price of hogs.	
Years	Cents.	Years.	Per 100 pounds.	Year	Cents.	Years.	Per 100 pounds.
1878-'79	34.6	1879	\$3.52	1882-'84	39.1	1884	\$5.75
1879-'80	38.5	1880	5.05	1884-'85	34.2	1885	4.12
1880-'81	51.6	1881	5.95	1885-'86	34.7	1886	4.25
1881-'82	56	1882	7.32	1886-'87	40.5	1887	4.88
1882-'83	45.4	1883	6.07	1887-'88	39.2	1888	5.82

The price of corn is evidently one of the important factors which determines the price of hogs and steers, as is demonstrated by the above tables, but where a number of influences are at work we should not expect any closer relation between these prices than is here shown. The question is a complicated one, and in the absence of data which would establish the exact number and weight of the cattle and hogs that are marketed each year, we can only hope to get a somewhat general idea of the supply and demand and the relative fluctuations of prices.

Now, going back to the causes which have led to the fluctuations in the mean price of steers, we find that the extraordinary advance of 1882 coincided with an even greater advance in the price of hogs, and that in each case the price must have been influenced to a considerable extent by the enhanced price of corn. The largely de-

creased price of steers in 1883 also coincided with an equal decrease in the price of hogs. In 1884 we find a decrease of 32 cents per 100 pounds in the price of hogs, and an increase of 38 cents per 100 pounds in the price of steers. This would appear to be due to the large exports of cattle and beef products in that year. In 1885 and 1886 the large number of cattle in proportion to population, the falling off of the export trade, and the low price of corn and hogs all exerted a downward influence on the price of cattle.

The price of hogs improved considerably in 1887, but the price of steers declined still farther. This was no doubt the result of the falling off in our export trade from \$27,320,390 in 1886 to \$21,853,718 in 1887. The slight advance of cattle prices in 1888 coincides with the much greater advance in the price of hogs, but must have been influenced also by the increased exports of cattle and beef products. The advance was very slight on account of the large number of steers marketed in proportion to the stock on hand. With the decline in prices the profit in cattle-raising has been greatly reduced, and in many localities this industry has been conducted at a positive loss. The inevitable tendency has therefore been to sell off the stock and reduce the business, and consequently the proportionate number of cattle marketed has been much greater than during the years from 1881 to 1884, when the industry was paying and the stock on hand was being increased. For this reason the markets of the country have not yet felt the influence of the reduction of the stock of cattle in proportion to the population, which the tables plainly show has occurred, and which must continue at an increasing rate from year to year.

The future tendency of prices with cattle will probably be to advance on account of the improbability of increasing the stock of cattle as rapidly as the population is augmenting. But this advance will be slow and uncertain for a number of years. It will be at least three years before the stock of cattle has been reduced to the proportion as compared to population which existed in 1878, and then the mean price of steers was but \$4.25 per 100 pounds, or 82 cents less than 1888. In other words, the price of steers for several years in the future will depend more upon the price of hogs, upon the value of the exports of cattle and beef products, and upon the proportion of steers marketed, than upon any changes likely to occur in the number of cattle per 1,000 of population which exist in the country.

UNITED STATES NEAT-CATTLE QUARANTINE.

The superintendents of the various neat-cattle quarantine stations report the names of the importers and the number and breed of each lot of animals imported during the year 1887, as follows :

GARFIELD STATION, N. J. (NEAR NEW YORK).

DR. W. HERBERT LOWE, SUPERINTENDENT.

Date of arrival.	Name and post-office address of importer.	Port of shipment.	Name of breed.	No. of animals.
1887.				
Jan. 25	Overton Lea, Nashville, Tenn.....	London.....	Sussex.....	26
May 7	John Dick, Quincy, Ill.....	Antwerp.....	Simmenthal.....	6
24	G. F. Taber, Patterson, N. Y.....	Hull, England.....	Red Polled.....	8
26	L. F. Ross, Iowa City, Iowa.....	London.....	do.....	9
June 6	S. A. Converse, Cresco, Iowa.....	do.....	do.....	21
July 25	E. S. Jameson, Mount Sterling, Ky.....	do.....	do.....	18
25	B. B. Lord & Son, Sinclairville, N. Y.....	Amsterdam.....	Holstein.....	4
			Friesian.....	
25	R. Renfrew, New York City.....	London.....	Ayrshire.....	1
Aug. 2	Overton Lea, Nashville, Tenn.....	Hull, England.....	Sussex.....	3
4	J. A. McKnight, Brooklyn, N. Y.....	Saint Helena.....	Polled.....	1
13	J. H. Offord, Topeka, Kans.....	London.....	Red Polled.....	30
13	William Hauke, Iowa City, Iowa.....	do.....	do.....	25
13	J. McLain Smith, Dayton, Ohio.....	do.....	do.....	5
Sept. 8	Charles C. Burns, Springfield, Mass.....	Havre, France.....	French.....	3
Oct. 26	E. N. Howell, New York City.....	London.....	Guernsey.....	6
Dec. 10	Benjamin T. Cable, Rock Island, Ill.....	Liverpool.....	Black.....	25
			Aberdeen.....	

LITTLEFIELD STATION, MASS. (NEAR BOSTON).

DR. A. H. ROSE, SUPERINTENDENT.

1887.				
Feb. 12	Luther Adams, Boston, Mass.....	Liverpool.....	Shorthorn.....	30
June 1	John A. Frye, Marlborough, Mass.....	London.....	Holstein.....	70
22	Morris & Clark, Lamoille, Ill.....	Glasgow.....	Galloway.....	100
Oct. 17	John H. Bass, Fort Wayne, Ind.....	Liverpool.....	do.....	20
22	H. W. Keys, Newbury, Vt.....	London.....	Holstein.....	29
Nov. 16	Hon. E. Barnett, Boston, Mass.....	Liverpool.....	Jersey & Guernsey.....	66
Dec. 22	Luther Adams, Boston, Mass.....	London.....	Shorthorn.....	77

PATAPSCO STATION, MD. (NEAR BALTIMORE).

DR. F. L. KILBORNE, VETERINARY EXAMINER.

1887.				
Feb. 25	H. Vaughn, California.....	Liverpool.....	Hereford.....	43

Table showing the whole number of cattle received at the various stations from January 1, 1887, to January 1, 1888.

Garfield Station.....	191
Littleton Station.....	292
Patapsco Station.....	43
Total.....	526

Table showing the number of cattle received at the various stations for each month in the year.

Month.	Garfield.	Littleton.	Patapasco.	Total.
January.....	26			26
February.....		30	43	73
May.....	23			23
June.....	21	170		191
July.....	23			23
August.....	64			64
September.....	3			3
October.....	6	49		55
November.....		66		66
December.....	25	77		102
Total.....	191	392	43	626

Table showing the different breeds of cattle and the number of each imported during the year 1887.

Breed.	No.	Breed.	No.
Shorthorn.....	107	French.....	3
Holstein.....	99	Black Aberdeen.....	25
Guernsey.....	6	Sussex.....	29
Jersey and Guernsey.....	66	Shamethal.....	6
Galloway.....	120	Red Polled.....	116
Holstein-Friesian.....	4	Hereford.....	43
Ayrshire.....	1		
Polled.....	1	Total.....	626

The superintendents of the various neat-cattle quarantine stations report the names of the importers and the number and breed of each lot of animals imported during the year 1888, as follows:

GARFIELD STATION, N. J. (NEAR NEW YORK).

DR. W. HERBERT LOWE, SUPERINTENDENT.

Date of arrival.	Name and post-office address of importer.	Port of shipment.	Name of breed.	No. of animals.
Feb. 24	Gillfillan & Murray, Maquoketa, Iowa...	London.....	Red Polled.....	17
24	William Hanke, Iowa City, Iowa.....	do.....	do.....	22
May 2	Mack Martin, Richland City, Wis.....	do.....	do.....	27
2	Smith & Jamison, Mount Sterling, Ky.....	do.....	do.....	22
2	L. F. Ross, Iowa City, Iowa.....	do.....	do.....	20
4	S. A. Converse, Cresco, Iowa.....	do.....	do.....	15
June 26	V. T. Hills, Delaware, Ohio.....	Liverpool.....	do.....	13
July 11	Hon. D. Magone, New York City.....	London.....	Ayrshire.....	3
Aug. 24	M. W. Dunham, Wayne, Ill.....	Havre.....	French.....	2
Sept. 26	C. W. Chapin, Springfield, Mass.....	do.....	do.....	2
Oct. 11	R. W. Brown, Merton, Wis.....	London.....	Red Polled.....	8
25	Adams Express Company, New York City.....	Bristol, England...	Shorthorn.....	2
Nov. 3	T. C. Eastman, New York City.....	Glasgow, Scotland..	Ayrshire.....	10

LITTLETON STATION, MASS. (NEAR BOSTON).

DR. A. H. ROSE, SUPERINTENDENT.

Mar. 6	John A. Frye, Marlborough, Mass.....	London.....	Holstein.....	26
May 22	N. P. Clarke, Minneapolis, Minn.....	Liverpool.....	Shorthorn.....	24
Oct. 1	H. S. Russell, Milton, Mass.....	London.....	Jersey.....	31
Nov. 19	Hopewell Brothers, Boston, Mass.....	do.....	Guernsey.....	15

PATAPSCO STATION, MD. (NEAR BALTIMORE).

DR. F. L. KILBORNE, VETERINARY EXAMINER.

Sept. 18	Hon. J. Stewart, Elburn, Ill	Glasgow, Scotland .	Polled Angus	10
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MOUNT AIRY STATION, PA. (NEAR PHILADELPHIA).

DR. A. C. YOUNG, SUPERINTENDENT.

Oct. 30	Charles W. Henry, Philadelphia, Pa.....	Antwerp	Swiss.....	11
10	Louis Bergdoll, Philadelphia, Pa.....	do	Holstein.....	6

Table showing the different breeds of cattle and the number of each imported during the year 1888.

Breed.	No.	Breed.	No.
Ayrshire	13	Red Polled	144
French.....	4	Shorthorn	26
Guernsey	15	Swiss	11
Holstein	32		
Jersey	31	Total	286
Polled Angus	10		

A new station was established at Philadelphia, Pa., in October last.

No contagious disease appeared among the cattle at any of the stations during the year.

GLANDERS.

In addition to the order of the Commissioners of the District of Columbia, by which the Chief of the Bureau of Animal Industry was made District veterinarian for the purpose of discovering and eradicating pleuro-pneumonia, a subsequent order has been issued which gives him authority to investigate as to the existence of glanders and to kill affected animals without compensation to the owner. The full text of this order is as follows:

OFFICE OF THE COMMISSIONERS, DISTRICT OF COLUMBIA,
Washington, August 21, 1888.

Regulation for the suppression and prevention of contagious, infectious, and communicable diseases affecting domestic animals in the District of Columbia.

Whereas the eighth section of the act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide the means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," authorizes and requires the Commissioners to take measures for the prompt suppression of all contagious, infectious, and communicable diseases affecting domestic animals in the District of Columbia, to prescribe regulations for disinfection, and such other regulations as they may deem necessary to prevent infection and contagion, as provided in said section, do ordain, declare, and publish the following:

Ordered, That all persons having the care or custody of any domestic animal in the District of Columbia affected or supposed to be affected with any infectious, contagious, or communicable disease shall isolate and forthwith report the same to the Chief of the Bureau of Animal Industry of the Department of Agriculture, or to some officer of said Bureau in said District, designating the place where the same may be found, and shall place the same at his disposal, and observe and follow such directions as such chief or officer shall prescribe in such case.

2. That it is hereby made the duty of all veterinary surgeons in said District, and sanitary inspectors of the health department of the District, and of every member of the metropolitan police force to inquire and report upon all known or suspected cases referred to in section one of this order.

3. That if any person or persons having the care or custody of any domestic animal in said District affected or supposed to be affected as aforesaid, shall secrete or conceal the same, or use any device to conceal the same or mislead the persons or officers who are charged with any duty in reference to such domestic animals, and all persons aiding therein, shall each suffer the penalty hereinafter prescribed.

4. That the Chief of the Bureau of Animal Industry only may cause the death of any so diseased or supposed to be diseased animal in said District upon orders oral or written from him for the death of such animal, and shall also prescribe the mode and place of death, which shall be strictly pursued in the destruction of said animal; and the bodies of such animals so killed shall be removed by the health officer of the District upon notice from said Chief.

5. That every person who shall violate any of the provisions of this regulation shall be fined in any sum not less than ten nor more than twenty-five dollars for each offense, to be enforced in the police court of the District of Columbia, in the name of the District, on information, &c.

Official copy furnished the Chief of the Bureau of Animal Industry, Department of Agriculture.

By order:

W. TINDALL, *Secretary.*

The investigations so far made show the prevalence of this malady to a considerable extent among the horses in the District. From

here affected animals have been frequently taken into Maryland and Virginia, scattering the disease and causing severe losses in those States. The presence of such a pest, dangerous not only to the equine race but equally fatal to mankind, calls for energetic measures of suppression. To this end prompt action has been taken whenever the disease has been discovered, and affected animals have been killed as soon as possible after a satisfactory diagnosis was reached. At the same time great care has been exercised that no animals should be condemned unless they presented the pathognomonic evidences of the affection. When practicable a *post-mortem* examination is always made to confirm the *ante-mortem* diagnosis. The number of horses killed in the District of Columbia because affected with glanders was: July, 1; August, 0; September, 2; October, 10; November, 1; December, 12; total, 26.

THE ETIOLOGY AND DIAGNOSIS OF GLANDERS.

Glanders is a contagious disease of importance, both from an economical and sanitary stand-point. It is not only communicated from one horse to another, but it is occasionally transmitted to man, producing a severe and generally fatal disease.

The consensus of opinion and of legislation to-day demands the slaughter of animals affected with glanders. Recovery of horses affected with this disease is perhaps never complete. In the great majority of cases it runs a course of variable length, the final result of which is death preceded by emaciation and general debility. Nor is there any remedy or cure for the disease. Granted even the possibility of recovery, the affected animal is in the meantime a source of continual danger to other horses and to human beings. It is therefore in the end economy to immediately destroy glandered horses when detected, even were human life not endangered by their presence.

But the diagnosis of glanders is not always an easy matter. It may be confounded with a number of other diseases, and when a very valuable animal is involved an accurate diagnosis is of great importance. Since the discovery of the bacillus of glanders in 1882 considerable attention has been paid to the matter of diagnosis, and we are in a position to-day to present a few valuable facts in this connection. In the following pages some space will be devoted to the consideration of the causation or etiology of the disease, with special reference to the specific bacillus and its biology, a brief account of experiments made both in our own laboratory and elsewhere to facilitate diagnosis.

ETIOLOGY.

The communicable nature of the disease among horses known as glanders and farcy is now thoroughly established by experiments, which have revealed its cause as a micro-organism belonging to the group of bacilli. These experiments date from the year 1882. The contagious character was, however, recognized long before this time and various experimenters had succeeded in producing the disease in horses and other animals by inoculating with the nasal discharges and other pathological products of the disease. In Germany the real character of glanders was recognized as far back as the first quarter of the present century. In France, however, there was a

strong opposition to those who held glanders to be a communicable disease, which opposition was not overcome until about thirty years ago.

Various efforts had been made in the last forty years to discover the actual cause of the disease, either in the blood of the affected animal or in the specific lesions of the air passages and the skin. The alleged discoveries in most cases were far from the truth, and at times sensational and absurd. Thus Hallier, in 1868, claimed to have found the same organism in glanders which he regarded as the cause of syphilis in man. The doctrine that syphilis originated in glanders had been promulgated before this, and was now seemingly confirmed by Hallier's fantastic inferences. In 1882 Roszahegyi described organisms which he found in the pustules of a man who had succumbed to acute glanders. His description warrants the belief that he was the first to see the bacilli of glanders. He did not go far enough, however, and failed to show any causal relation between these organisms and the disease. In 1882, Löffler and Schütz published the first positive results obtained in isolating the bacillus of glanders, which have been confirmed by a number of observers subsequently. Meanwhile work had been going on in France in the same direction. Bouchard, Capitan, and Charrin published in 1883 the results of cultivation and inoculation experiments dating back to 1881, which they claimed as decisive in demonstrating the microbe of the disease. A careful perusal of Bouley's note to the Academy of Medicine in 1883 (*Bull. Acad. Médecine*, 1883, p. 1239) will, however, convince any unbiased reader that the methods which they employed (in one case they made cultures from a nasal ulcer in bouillon, in another from a spleen tubercle in bouillon) are either unsafe or insufficient in bringing about any positive results as to the true nature of the specific microbe. We must therefore accord to Löffler and Schütz the credit of being the first to have demonstrated in a satisfactory manner the presence of a certain microbe in glandered horses and its capacity of producing the disease in healthy horses. A brief résumé of their work* will serve at the same time as a description of the bacillus as they found it in the lesions and in cultures, and as an introduction to the work done on the same subject in the laboratory of the Bureau.

The authors found considerable difficulty in demonstrating the presence of glanders bacilli in sections of nodules in the spleen and liver of glandered horses, owing to the fact that most of the staining agents failed to color them. Finally, the following solution was made, which now goes under the name of Löffler's stain: 30 cubic centimeters of a concentrated alcoholic solution of methylene blue was added to 100 cubic centimeters of .01 per cent. potassium hydrate. When sections were placed in this deep-blue liquid for about 5 minutes, transferred to a 1 per cent. solution of acetic acid for a few seconds, then dehydrated in alcohol and cleared in cedar oil, very delicate bacilli could be detected now and then, especially near the periphery of young nodules. As a rule they were very rare, but no other organisms were found.

Löffler recommends for the study of the bacilli of glanders, both on cover-glass preparations and in sections, very recent nodules from the lungs of inoculated guinea pigs, as the bacilli are quite numerous in

*The full publication of their experiments will be found in *Arbeiten a. d. Kaiserlichen Gesundheitsamte*. Berlin, 1886, I, p. 131, and their preliminary report translated in volume 95 of the New Sydenham Society, 1886.

this situation. For cover-glass preparations he found the following solution to give the best results: Aniline water gentian violet,* or fuchsin is mixed with an equal volume of .01 per cent. caustic potash, or $\frac{1}{2}$ per cent. liquor ammonia, directly before using. The cover-glass preparation † is stained by floating the cover-glass with the film down on the staining fluid for about five minutes. It is then dipped for a second into 1 per cent. acetic acid to which a watery solution of tropaeolin 00 ‡ has been added until a wine-yellow color is obtained, and then washed in distilled water, after which operation it may be examined or mounted in balsam for preservation.

From the nodules and tubercles in the liver, spleen, and lungs the contained pus was used to inoculate tubes containing various culture media, both liquid and solid. A special value was put upon those lesions which do not in any way come in contact with the external air, such as those in the spleen and liver. Within three days the surface of those tubes containing blood serum appeared as if sprinkled with minute yellowish, translucent droplets. These droplets were made up of very delicate rods or bacilli, varying in length between one-third and two-thirds of a red corpuscle. Their width was from one-fifth to one-eighth of their length. They were either straight or slightly bent, with rounded extremities, and in general somewhat shorter and thicker than tubercle bacilli. In liquids they manifested active Brownian movement, but true spontaneous movements were never observed. They were without doubt identical with the delicate rods observed in sections under the microscope.

Of the biological character of bacteria, their growth or multiplication outside of the body on various substrata is very important, for by this means of so-called cultivation we can determine how far they are capable of growing in our environment and thus keeping up the infection, between what temperature limits multiplication may take place, also whether any resistant spore state is entered upon during their life. There is still another advantage to be derived from cultivation—one which mainly concerns us now—the ability on our part to diagnose between one organism and another by characters of growth discernible with the unaided eye. The bacilli of glanders have certain features in cultures which are of great use in distinguishing them from other organisms.

They grow very well on blood serum from horses and sheep, less abundantly on that from cattle. On the third day after inoculation of such media, minute droplets of a translucent yellowish color appear on the surface of the serum. These droplets or "colonies" consist entirely of bacilli which have descended from perhaps a single bacillus originally deposited there. The material composing the droplets is of a viscid consistency, and may be drawn out on the platinum needle into thin threads. After eight or ten days this yellow translucency is replaced by a milky opacity.

* This stain, used in the study of tubercle bacilli, is made by shaking up 5 cubic centimeters of aniline oil in 100 cubic centimeters of water and filtering. To the filtrate is added 11 cubic centimeters of a concentrated alcoholic solution of the aniline dye to be used, in this case either gentian violet or methyl violet or fuchsin.

† Prepared by crushing the nodule between the ends of forceps and rubbing it in a very thin layer on the cover-glass. When thoroughly dry it is seized with the forceps, drawn three times through the flame of a Bunsen burner, the film side being held up or away from the flame. Pus from abscesses is rubbed in a very thin film on cover-glasses and treated in the same way.

‡ This is not essential,

A very good soil for the multiplication of these bacilli is the cut surface of boiled potatoes. Löffler and Schütz describe the very characteristic appearance substantially as follows: Already on the second day the surface of the potato is covered with a delicate yellowish, translucent layer, which becomes amber-colored later on. After six or eight days a reddish color appears; the transparency is lost and the color suggests the red of cuprous oxide. The potato surface bordering the growth assumes a pale greenish appearance. This description applies very closely to the potato cultures made in the laboratory of the Bureau. A very striking appearance is produced when bits of tissue are used to inoculate the potato, since the bacilli not being very numerous, the colonies appear isolated instead of being fused into a uniform layer. They are exceedingly small at the beginning of the third day, scarcely recognizable. Towards the end of the third day, the cultures being kept at 37° C., the colonies are visible as minute hemispherical masses of a delicate translucent, pale-yellow tint. In fact the cut surface of the potato appears as if sprinkled with a pale-yellow serum. Gradually the color changes as above described and the colonies fuse into an opaque layer.

The probability of a multiplication outside of the animal organism of glanders bacilli is very slight. Experiments have shown that they do not develop when the temperature is less than 25° C. (77° F.), and then only on certain substances, such as boiled potato, blood serum, *agar-agar* with peptone. When infusions of hay, straw, oats, wheat, and manure, such as form in and around stables, were inoculated with glanders bacilli no multiplication took place even at the most favorable temperature. Owing to the high temperature necessary for this multiplication gelatine can not be employed as a culture medium.

It has already been stated that glanders bacilli have no movement of their own. This I can confirm from numerous observations. Only the slight dancing movement observed among all bacteria suspended in liquids could be detected. There seems to be a difference of opinion, however, on this important point. In Eisenberg's *Bacteriologische Diagnostik* they are characterized as actively motile, and this statement is repeated in a second edition recently issued. If this difference of opinion depends on a difference in interpretation of the same object, it is high time that bacteriologists define clearly what is meant by motility.

My own observations differ from those of Löffler and Schütz in regard to its growth in liquids. They state that in neutralized bouillon prepared from muscular tissue of man, horse, sheep, rabbit, beef, and fowl, with or without 1 per cent. peptone, it multiplies very well. At the end of the second or third day the liquid becomes clouded, and finally a viscid, whitish deposit forms. Our observations extend only to cultures in slightly alkaline beef infusion peptone. These have never shown a perceptible clouding. The liquid remains limpid, and one might say after a short inspection of the tubes that there was no growth. When vigorously shaken up, however, a yellowish-white deposit is seen rising from the bottom as a twisted column when the culture is one or more weeks old. This very viscid mass consists of glanders bacilli. It is probable that by varying the reaction of the liquid slightly, or the meat employed, a fluid medium may be obtained in which the bacilli of glanders as found in our country may grow like those studied in Berlin. At all events, so far as my experience goes, I should feel very suspicious of

a bouillon culture of glanders which became clouded in two or three days after inoculation.

Glanders bacilli change their form more or less in cultures as the latter grow older. This is without doubt a degenerative process, and the changed bacilli are dead or nearly so. True rod forms are seen in sections of tissues and in very young cultures only. In older cultures they no longer appear as true rods, but the change of form is not easily made out, owing to the minuteness of the objects under examination. A frequent form is that of an oval and even a coccus, in which the stained area is limited to one side or frequently to the two poles, leaving an intervening clear space, which has been described by some observers as a spore. It has no refractive power, however, and can only be considered an empty space in the interior of the bacillus. Other degenerative or involution forms, giving rise to the appearance of a chain of cocci, are now and then observed. It must not, therefore, be inferred that cultures of glanders bacilli are necessarily impure when very few slender rod forms are met with.

DIAGNOSIS OF GLANDERS.

The foregoing brief description of glanders bacilli and of their cultures is of great service in diagnosis. Cultures made from the spleen or liver tubercles of slaughtered horses, exhibiting the characters already described, would prove beyond a doubt that the animals had been affected with glanders. But veterinarians in most cases are able to make a diagnosis on *post-mortem* examination without the aid of cultures. The question to-day is whether glanders can be positively diagnosed in the living animal, especially when the gross appearances of glanders are obscure and the animal is a valuable one.

If cultures of the specific bacilli could be obtained directly from the living animal the problem would be very simple. Those accessible organs or parts of the horse which may be the seat of disease are the nasal passages, the submaxillary glands, and the skin or subcutaneous tissue. Frequently only one of these parts is involved. But it is impossible to make cultures from the nasal ulcers or discharges because they contain, besides the specific bacilli, many other bacteria. In tubes inoculated from such material a single day would suffice for the rapid multiplication of the other bacteria so as to entirely crowd out or bury up any glanders bacilli that may have been present, as the former grow many times more rapidly. When nodules are present under the skin it is highly improbable that the bacilli can be obtained therefrom in pure cultures during the life of the animal, owing to the danger of contaminating the cultures. When the nodules have once broken down into ulcers numerous other bacteria lodge in them, and cultures are then out of the question. It has been suggested recently that the enlarged submaxillary glands be removed and examined for glanders bacilli. Thus far we do not know in what numbers they are present in these enlarged glands, and it would require considerable preliminary study to determine whether cultures are successful when made from them.*

The direct determination of glanders by means of microscopic examination and cultivation is thus far not feasible.

The question might be asked, Why not isolate the glanders bacilli from the impure discharge from the nose, or from ulcerated farcy buds, as we should do in searching for the comma bacillus in the

*See the end of this chapter with reference to this point.

bowel discharges of Asiatic cholera? This might unquestionably be done, but it would be a very tedious method, requiring much minor apparatus and still more patience, and in the end the result might be negative. The reasons for this are various. Glanders bacilli do not grow in gelatine at the temperature at which plate cultures can be used. Agar plates might be used, but germs grow upon agar very much alike, and as glanders bacilli are, as a rule, very scarce in discharges, the labor of examining microscopically a large number of colonies to find the right one would become very great. Finally, they grow very slowly, and would be in danger of being overrun by the colonies of putrefactive germs which grow very rapidly in the thermostat.

Cadeac and Roy (*Journal de Médecine Vétérinaire*, May, 1888) made cultures on potato directly from the nasal discharges of various animals, and claimed from the similarity of the color of the growth from these different sources to cultures of glanders bacilli that this method of diagnosis is of no value. The authors have entirely mistaken the method. Neither Löffler nor any other subsequent German observers have maintained that cultures made on potato from the nasal discharges or any other product in contact with the air have any value whatever. The fundamental principles of bacteriology are directly opposed to the indiscriminate cultivation of a number of germs on the same substratum, and especially the potato. Only those disease products which have not yet been exposed to the air, or which are buried in the depths of vital organs, can be used for cultivation.

The method which is now in use more or less, and which was perfected by Löffler and Schütz, consists in inoculating small animals, more especially guinea pigs, with the disease products. These in turn develop the disease, the nature of which may then be determined by the lesions of the inoculated animals, both internal and external, or more positively demonstrated by cultures from the various organs. In this method the animal body becomes, so to speak, the culture flask, and a very perfect one, too, for it not only permits the disease germs to multiply in the various organs, but it also speedily destroys all other germs inoculated at the same time, leaving the glanders bacilli in entire possession of the field.

The inoculation of species of animals other than the horse and ass, which are naturally susceptible to this disease, has been tried by many investigators. These experiments need not be recounted here, as they are not pertinent to the subject under discussion. They have shown that cattle are insusceptible; that goats and sheep may take the disease after inoculation, the former even spontaneously. Lions and tigers in menageries have contracted glanders by feeding upon the raw flesh of glandered horses. Cats contract the disease in the same way and are susceptible to inoculation. Dogs are less susceptible than cats, both when fed and inoculated. Coming to those smaller animals which might serve a useful purpose in making a diagnosis, we also find great variety in the relative susceptibility. Among those which have been tried are rabbits, guinea pigs, white mice, white rats, field mice (*Arvicola arvalis* and *Arvicola terrestris*), pigeons, fowls, and several other rodents. Of these the white mice, white rats, and fowls were found practically insusceptible; the rabbits varied in this respect; some contracted the disease after inoculation, others did not. Guinea pigs and field mice proved to be uniformly susceptible when inoculated, both with material directly from the animal and with bacilli from cultures.

The course of the disease and the lesions produced in guinea pigs are well described by Löffler. As a place of inoculation he chose one side of the abdominal surface, about half way between the axilla and the groin. The hair was carefully cut away, a fold of skin raised and cut through completely with scissors. Into this incision, about two-fifths inch long, a flamed needle was introduced and moved to and fro under the skin, to form a little pocket for the reception of the infectious material.

At the place of inoculation an ulcer forms during the first week, with suppurating base and thickened border. Towards the end of the first week the nearest lymphatic glands, in this case those near the groin, begin to enlarge. The lymphatics themselves do not, however, swell into cords, as is true of farcy in the horse. The glands grow to the size of hazel-nuts, sometimes larger, and their contents soften into a puriform mass. The capsule as well as the skin over it may rupture and the contents discharge on the surface. When this takes place early, numerous glandular bacilli are found in the discharged pus. In some animals the disease may stop here and the ulcer heal. The primary ulcer usually heals in from two to three weeks. The guinea pig after four to six weeks may have entirely recovered. In the majority of guinea pigs, however, the disease ends fatally. In the second week the testicles of the male contain hard, nodular places. Inflammation sets in, the overlying skin becomes red and oedematous, and finally breaks. Puriform masses, containing numerous bacilli, are discharged. In females the labia and mammae more rarely inflame and suppurate. At about the same time one hind or fore foot may begin to inflame, swell, and give rise to great pain on pressure. Sometimes the inflammation may leave one foot and appear in another; more rarely all feet may be affected. They may also become ulcerated, but as a rule the death of the animal ensues before this takes place. Besides these characteristic changes in the feet and testicles, there may be nodules in and under the skin in different regions of the body which may also break and form ulcers. In the face these nodules start from the periosteum, or even the bone itself. The mucous membrane of the nose was involved in only one-third of the eighty-five cases studied by Löffler. The disease process was first noticed at about the same time with the swellings of the feet, and manifested itself by difficult breathing and sneezing. The secretion is scanty and dries up into brownish crusts around the external nares. This lesion is speedily followed by emaciation and death, which usually takes place in the third or fourth week, sometimes as early as the second and as late as the eighth week.

At the autopsy the place of inoculation may be occupied by an ulcer or healed and cicatrized. The inguinal or axillary glands are swollen and contain small abscesses, or the whole gland may have been converted into pus inclosed in the gland capsule. In the skin are abscesses as large as peas or hazel-nuts, in part healing. One or more feet are swollen. The swelling may be due to a periarticular abscess, to inflammation of the joint itself, or of the ends of the bones forming it. The lungs usually contain a variable number of small grayish-yellow nodules, situated chiefly under the pleura. In almost every case the spleen is involved. It is enlarged, and contains a large number of minute, slightly projecting, yellowish nodules, some attaining the size of a pin's head. They are frequently found in the liver, though in smaller numbers. In the omentum, the suspensory

ligament of the liver, and the retro-peritoneal tissue small abscesses may be found. In the testicles, and more especially the epididymis, the earlier stage of the disease is indicated by the presence of reddish-gray nodules as large as pins' heads. Later on these have been converted into larger, cheesy masses, in some cases broken through the skin. In females the ovaries are rarely involved, more commonly the mammæ. The mucous membrane of the nose is usually reddened and swollen. Small ulcers may be present on the septum and the turbinated bones. The presence of glanders bacilli is determined microscopically without any difficulty when the disease process is recent. When suppuration has set in it becomes more and more difficult.

Löffler also experimented with field mice (*Arvicola arvalis*), which he found very susceptible to inoculation with cultures. In most cases death ensued from three to five days after inoculation into the subcutaneous tissue near the root of the tail. The spleen and liver were quite invariably crowded with barely visible nodules. Rarely the joints of the feet became diseased. Lesions in the lungs and skin were absent.

Kitt,* experimenting upon wood mice (*Mus sylvaticus*), found them very susceptible to inoculation. When either cultures of glanders bacilli or bits of tissue containing them were placed under the skin of these animals they lived from eight days to one month thereafter. The spleen was very much enlarged, dark red; on its surface and on section were numerous grayish-yellow nodules barely the size of a pin's head. At the place of inoculation there is usually a dry scab, accompanied occasionally with some suppuration or œdema. From the experiments noted by the author it would be difficult to infer how far these mice are of value in making diagnosis from nasal discharges—that is, how far they are capable of resisting septic infection.

In a more recent communication (*Oesterr. Monatsschrift f. Thierheilkunde*, January, 1888), the same author experimented with a species of rat (*Arvicola terrestris*). Of fourteen inoculated with pus from a glandered guinea pig into the subcutaneous tissue of the abdomen, all died in from four to ten days. There is usually an ulcer formed at the place of inoculation, with enlargement and suppuration of the neighboring lymphatic glands, enlargement of spleen, which contains numerous yellowish-white nodules. Not infrequently grayish nodules are present in the lung tissue. Besides these rats, *Erinaceus Europæus* was also tested with reference to its susceptibility to glanders. Inoculation was uniformly successful. The spleen and lung tissue were the chief seat of the disease, both being infiltrated with tubercles readily visible to the naked eye. But to these animals the same objection applies in so far as they were tested with material containing glanders bacillionly, which does not prove their utility when septic material must be inoculated. Their resistance to septicæmia can only be determined by inoculating the nasal secretion from glandered horses.

In Russia the bacteriological station at Odessa† reports favorably the use of a rodent (*Spermophilus guttatus*) which takes the place of our prairie dogs in that country, and is closely related to it. Of

* *Centralblatt für Bacteriologie*, 1887, ii, p. 241.

† Kranzfeld: *Zur Kenntniss d. Rotzbacillus*. *Centralbl. f. Bacteriologie*, 1887, ii, p. 273.

twenty-eight inoculated sixteen died on the fourth day, nine on the fifth, two on the seventh, and one on the tenth day.

Of these animals, nearly all of them rodents, the guinea pig is considered the most satisfactory. The other animals are more or less susceptible to septicæmia caused by bacteria present in secretions and discharges in contact with the air. They are therefore liable to die of septicæmia before glanders is developed. At the same time this does not exclude the use of these rodents when guinea-pigs are not to be had, provided a sufficient number, say, at least five or six, are inoculated from the same horse. They would require a careful bacteriological examination to make sure of the nature of the disease. In guinea pigs, on the other hand, the external signs of disease, such as the swelling and suppuration of lymphatic glands, testicles, and feet, the formation of abscesses and ulcers in and under the skin, and the not infrequent nasal disease, are sufficient of themselves to decide the question without bacteriological evidence. Guinea-pigs very rarely die of septicæmia or putrid changes under the skin as the result of inoculation.

The animals above mentioned are not indigenous in our own country. Dr. C. Hart Merriam has kindly furnished the names of a few American representatives or closely allied forms. *Arvicola riparius*, the meadow mouse, may be used for *Arvicola arvalis*; for *Arvicola terrestris*, *A. austerus*, for *Spermophilus guttatus*, *Sp. Townsendi* or *Sp. Richardsoni*, which is common in northern Dakota. Of *Erinaceus Europæus* there is no American representative.

Those who are called upon to make diagnosis of glanders should endeavor to always have a supply of guinea pigs on hand. In order to make the diagnosis of value Löffler recommends that from three to five should be inoculated, and not simply with a prick of the lancet, but larger quantities (a large drop) of the mucus from the nose should be placed in a pocket under the skin, as already described. The greater number survive the inoculation and show positive signs of glanders in two weeks. Males should be used whenever possible, owing to the characteristic lesions of the testicles.

The following experiments were made during the year 1888 with the purpose of determining how far the statements in the preceding pages could be relied upon in making a diagnosis. The great majority of the inoculations were made upon guinea pigs from the nasal discharges of glandered horses. Many of the latter had ulcers on the septum of the nose which could be seen, so that the diagnosis of glanders was made without resorting to inoculation:

I. January 21 two adult guinea pigs (Nos. 1, 2) were inoculated with a lancet, the material being taken from nodules in the lungs of a glandered horse. No result.

II. April 13 two guinea pigs (Nos. 3, 4) were inoculated subcutaneously on the left side of abdomen with nasal discharge from a horse suspected of chronic glanders. Guinea pig No. 3 was found dead May 5. It had for ten days previous nasal discharge. At the autopsy the following lesions were noted: Left fore limb and right hind limb very much swollen. In the right inguinal region an ulcer with ragged border one-half inch across. The left inguinal lymph gland enlarged and containing several whitish nodules about the size of a hemp-seed. In the nasal passages considerable purulent matter. Spleen enlarged, thickly dotted with very small whitish masses.

From this animal no cultures were made, but two fresh adult male guinea pigs were inoculated each from the spleen and inguinal gland by taking bits as large as hemp-seeds and placing them under the skin. One of them has, on May 20, an open, dry sore, one-half inch across, adjacent to the place of inoculation. The inguinal gland and testicle are considerably enlarged. The skin over the latter is becoming abraded. Some days later the right fore limb was very badly swollen. It was killed June 4.

There were several small ulcers on the surface of the body; the right fore foot swollen. From the spleen cultures were made on *agar*, potato, and in beef infusion. All remained sterile. The other guinea pig recovered. The inguinal gland had been slightly enlarged at one time.

Guinea pig No. 4, inoculated with nasal mucus April 13, showed only slight enlargement of axillary and inguinal lymphatics May 5. Four days later, the right fore leg was badly swollen, and an ulcer had formed on the top of the nose. It was killed with chloroform May 12, twenty-nine days after inoculation. At this time the swelling of fore leg had subsided, the place of inoculation had healed, but the neighboring inguinal gland was one-half inch in diameter. Spleen slightly enlarged, very pale. Liver dark. In neither are nodules discernible. Cultures were made from spleen and the enlarged gland. The hair was carefully clipped away and the skin blackened with a red-hot spatula in the line of the proposed incision. A flamed knife was then thrust into the gland, which was found converted into a soft, white, cheesy mass. The *agar* cultures from spleen remain sterile. Those from inguinal gland contain on the third day colonies of glanders bacilli. On the potato inoculated from the gland about twenty translucent, serum-like colonies appear from 1 to 2 millimeters in diameter. Examination shows them to be made up of glanders bacilli.

Bacilli from this culture, suspended in sterile beef infusion, were injected subcutaneously into a guinea pig on the left side of abdomen May 15. Five days later the testicles began to enlarge, and within three weeks they were both $1\frac{1}{2}$ inches in diameter. The animal was killed June 4. The spleen was slightly enlarged, but without nodules. At the place of inoculation a fluctuating mass under the skin, about one-half inch in diameter, filled with a soft, cheesy, yellowish-white pus. On both testicles were ragged, blackish depressions, as if the skin either had broken or was about to do so. The contents of both were entirely converted in yellowish-white, cheesy pus. From one of them cultures were made, as indicated above. On the third day typical colonies of glanders bacilli had appeared.

III. April 6, two guinea pigs were inoculated subcutaneously with scrapings from the base of ulcers on the nasal septum of a horse killed for glanders. Up to May 10 the place of inoculation had healed in both cases. In one, an inguinal gland and the testicles were enlarging. May 26, this one was killed, as it was growing gradually worse. At the autopsy the left inguinal gland was about one-half inch in diameter, the contents easily expressed as a thick creamy pus. The inguinal gland of the other side about half as large. The left testicle has a broad scar with blackened base, evidently a rupture through which the contents had been discharged, which accounts for the shrunken size of the gland. The other testicle consists of two enormous abscesses, apparently not communicating with each other (testicle and epididymis), containing liquid pus. Between the nose and the right eye an ulcer with a blackish dried-up base and irregular margins. Two days later a potato culture, made from the spleen, contains a moderate number of isolated colonies characteristic of glanders. An *agar* culture did not grow. From one testicle two *agar* cultures contain numerous colonies. From the enlarged inguinal gland both an *agar* and a potato culture developed numerous colonies. These were characteristic, both macroscopically and microscopically, of glanders.

From the potato culture of the inguinal gland, when ten days old, two mice were inoculated by injecting subcutaneously a few drops of a suspension of bacilli in sterile bouillon. Both remained well. The second guinea pig, inoculated from the same horse, did not take the disease.

IV. April 27, a young female guinea pig and a rabbit were inoculated with pus from farcy buds (glanders of the skin). The rabbit remained well; the inoculation wound was healed at the end of two weeks. In the guinea pig the wound had also healed, but the inguinal gland was beginning to enlarge. May 16 the gland was much larger, and the labium on the same side was beginning to swell up. May 20, a swelling about the size of a walnut appeared under the skin above the hip of opposite side. This broke later on. Found dead May 24. Besides the lesions already mentioned both fore feet and the right hind foot were swollen. The contents of the enlarged inguinal gland were puriform. In the labium a small abscess. Cultures were made on various media from the spleen, lymph gland, swollen labium, and blood. Those from the spleen and gland were pure cultures of glanders bacilli; those from labium impure.

From the spleen and inguinal gland of this guinea pig two young male guinea pigs were inoculated May 24, each receiving a minute portion from both sources. June 7 one was killed. Both fore feet are swollen over the carpal and metacarpal joints; the right has a depressed place concealed by a scab. The left hind limb is also swollen over the tibio-tarsal joint. The place of inoculation is covered by a scab. The inguinal gland and testicles are not swollen. The internal organs are

not visibly altered. Cultures were only made from spleen pulp on *agar*, which remained sterile.

The second guinea pig recovered.

V. June 4, from the nasal discharge of a horse affected with glanders, two guinea pigs, two young rabbits, and a young dog were inoculated, all in the same manner under the skin, as already indicated. One of the guinea pigs died July 9. It had a large ulcer with black dried-up base behind the left nostril, three on abdomen, and one on the right flank three-fourths inch in diameter. There was also an ulcer on the left heel and right fore limb. The right heel was considerably swollen. The left testicle was also quite large. The spleen was free from nodules. Cultures on *agar* and potato were made from the spleen only. These were found subsequently to be impure.

The second guinea pig had large swellings in the groin, and was unable to use its hind limbs for a time, but it finally recovered. The rabbits and dog were not affected. At the autopsy of the horse, from which these had been inoculated, the left nasal passage and adjacent sinuses had the mucous membrane partly thickened and eroded. There were also nodules in the lung tissue.

VI. July 27, three guinea pigs were inoculated subcutaneously as before with nasal discharge from a horse affected with glanders. One of these, a small male, died August 11. On the right side of abdomen an ulcer about three-eighths of an inch in diameter, with a cup-shaped, dark, dry crust covering it. When removed, a soft, cheesy mass, involving subjacent muscles, is exposed to view; serous surface not involved. No enlargement of gland. Putrefaction had set in and no cultures were therefore made.

At this time a peculiar disease was carrying off healthy guinea pigs quite rapidly, which was traced to the dry food given them. It is probable that this guinea pig also died of this disease, although evidently infected with glanders. The second guinea pig died during my absence and no examination was made. The third, however, developed glanders in a marked degree and was killed August 23, twenty-seven days after inoculation. On the right side of abdomen, near median line, an indurated mass covered by a black crust. The abdominal muscles and the peritoneal covering are intact, but between them and the crust is a cheesy mass. Similar ulcers exist on right flank and on right thigh externally. The right fore limb and both hind limbs are swollen, especially the right hind limb. This is three-quarters of an inch thick, bluish, ulcerated between first and second toe. Internal organs seem unchanged, although the spleen contained glanders bacilli. On each of three potato cultures from this organ from 15 to 25 typical colonies appeared within three days.

VII. September 21, two guinea pigs were inoculated with nasal mucus from a horse suspected to be affected with glanders. One died October 12. There were two ulcers on the abdomen about one-half inch across, the floor of which was formed by the muscular wall of the abdomen. The inguinal gland of the same side as large as a walnut and containing a cream-colored, liquid pus. Spleen, not enlarged, contains a large number of minute whitish dots.

In all cultures on potato, from both spleen and pus of inguinal gland, the typical pale yellowish colonies of glanders subsequently appeared. The second guinea pig was killed with chloroform October 16. At the place of inoculation a small ulcer had formed and the nearest inguinal lymph gland was equal in size to a small marble. The left testicle was enlarged and contained a pus cavity. The spleen small. From the pus of the testicle an *agar* culture was prepared; a potato culture from the spleen. Only the former developed colonies of glanders bacilli.

VIII. September 22, two guinea pigs, inoculated with nasal mucus from a horse probably affected with glanders. One died September 31, very much emaciated. Over lowest ribs on the left side a cheesy nodule, about one-half inch in diameter, representing the place of inoculation. The inguinal gland of same side as large as a small bean. On the same side the subcutaneous tissue is infiltrated with a translucent exudate, sufficient to make the surface of the muscles and under surface of the skin glistening and slippery (malignant oedema?). In spleen about 15 tubercles, grayish, 1 millimeter (one-twenty-fifth inch) across; on the various lobes of the liver similar but smaller tubercles; on lungs grayish subpleural nodules, irregular in outline, embedded in areas of a dark red hepatization.

Two potato cultures were made from spleen tissue and within three days twenty to thirty drop-like colonies, resembling a pale-yellow serum, so characteristic of glanders bacilli, made their appearance.

The second guinea pig was chloroformed October 15. In the left groin the lymph gland is converted into an abscess, about the size of a marble, containing a soft, cheesy, cream-colored pus. The right testicle, enlarged, contains an abscess; a few nodules in spleen. A potato culture from the latter organ failed to develop.

IX. November 29, from a horse killed and found glandered, a guinea pig was in-

oculated by inserting^g some purulent matter from the ulcerated septum under the skin. It died December 13. At the place of inoculation just behind the right fore limb an ulcer covered with a thin scab. Underneath, a thin grayish layer of pus. Near this ulcer is a nodule equal in size to a small bean containing soft curdy pus. The inguinal gland of the same side is equally large, one-half of it converted into pus. Spleen pale, slightly enlarged, and dotted with a large number of grayish points. Testicles in abdomen not yet affected, but the fold of skin surrounding anus on the left thickened and superficially ulcerated. On section a number of yellowish nodules in the thickened fold. One retro-peritoneal gland as large as a marble and converted into pus. Convex surface of both lungs dotted with a small number of bright-red points.

From the spleen and from the abscess under the skin three potato cultures and one *agar* culture were made. All developed numerous characteristic colonies of glanders bacilli on the third day.

An inspection of the autopsy notes will show that nearly all inoculated guinea pigs showed unmistakable signs of the disease, and that only a few recovered. Of those that were killed the lesions were such as to preclude recovery. In most cases the diagnosis of glanders could be made without having recourse to cultivation. In order to be thus successful it is necessary to observe strictly the method given for inoculation, and to avoid the error of using too small a quantity of the nasal discharge. It will also be noted that the lesions characteristic of glanders in guinea pigs did not all appear in the same animal. In some, enlargement and suppuration of the inguinal glands was the only external sign; in others swelling and suppuration of the testicles took place. Again, abscesses becoming ulcers later on appeared in different parts of the body, combined with swelling of the limbs. When the external lesions were prominent internal lesions were generally less marked. The formation of nodules in the spleen was infrequent, in the lungs rare, and in the liver observed in but one case. In general, internal changes were secondary to external.

Cultivation of glanders bacilli from inoculated guinea pigs is always desirable though not absolutely necessary in many cases. The foregoing notes show that pure cultures may always be obtained from still unopened abscesses under the skin, such as those of glands and testicles, by following the method already mentioned, *i. e.*, thoroughly scorching the surface of the skin after removing the hair and then making the incision through the scorched area. This makes unnecessary the use of disinfectants. Cultures from the spleen are not always successful, when those from the abscesses are, perhaps because the bacilli are not always present in the internal organs in numbers large enough to inoculate a culture tube. Hence, it is always advisable to inoculate from any abscess that can be reached from the skin or any suppurating gland in the abdomen.

Cultures from the spleen were made by tearing off a bit of spleen pulp from the carefully exposed spleen and rubbing it gently with the platinum wire over the *agar* or potato surface, so as to free the bacilli from the tissue and distribute them over a larger surface. In this way very fine cultures of isolated colonies on potato can be obtained, which in the earliest stages, when the colonies just begin to be visible to the naked eye after a sojourn in the thermostat at 37° C. for forty-eight to seventy-two hours, are very characteristic. The *agar* cultures I have found less characteristic and hence less valuable for purposes of diagnosis. Cultures from the pus of abscesses contain a much larger number of colonies, and these are apt to be confluent unless a very small quantity is used. It is best to make several inoculations with different quantities of pus.

The potatoes used were prepared according to the method suggested by Bolton (*Medical News*, 1887, i, 318). They are pared and cut in such a way as to fit into large test tubes. The top is cut so as to form an inclined surface upon which the inoculated material is to be deposited. A small amount of water is put into the test tube to keep the lower end of the potato constantly wet. The tubes are then plugged with cotton wool and kept in the steam sterilizer from one and one-half to two hours. If then the lower end of the plug is dipped into sterile melted paraffine the evaporation and consequent drying up of the potato is reduced to a minimum. In such tubes glanders bacilli grow very well, and as a rule their growth will depend on the condition of the potato surface as regards moisture. There will be no growth, or at best a very feeble growth, if the surface of the potato is partly dry and hard.

Of the few house mice, rabbits, and the dog inoculated none took the disease, thus confirming the results of Löffler and others that these animals are not proper subjects for inoculation.

It is, in general, best to chloroform guinea pigs when the lesions have become pronounced, especially when the cultures are desired. If allowed to die the term of the disease is unnecessarily prolonged; they are very apt to die at night, and in midsummer decomposition immediately sets in. Moreover, death may take place through secondary infection of the body with septic bacteria, which enter through the ulcers. In such cases pure cultures can no longer be expected. It is often necessary to make a diagnosis as speedily as possible, to release or destroy the suspected horses as the case may be. Hence, as soon as the external lesions, such as suppuration of the glands or testicles, has fairly begun, the animal may be killed and cultivations made from the pus in these organs. This may be all the more desirable if several guinea pigs have been inoculated at the same time, one or more of which should be kept for future examination if the first should fail to yield any positive result.

Diagnosis of glanders by extirpating the submaxillary lymphatic glands and making cultures therefrom.—It has been suggested that the diagnosis of glanders in the horse may be made directly by removing during life the swollen submaxillary glands situated on the under surface of the lower jaw and making cultures from them. Such operations can of course be undertaken only by veterinarians. Occasionally the swelling of these glands is the first suspicious sign. The swelling may be simply due to an increase and condensation of the substance of the gland. When the disease has existed for weeks and months the interior of the lobes of the gland usually contain minute cavities filled with a dry, caseous substance. These are considered almost diagnostic by Dieckerhoff.

Rieck (*Zeitschr. f. Thiermedizin*, 1888, xiv, 107), recently reported a case in which the diagnosis was made in this way:

A seven-year old mare from a stable in which 6 cases of glanders had occurred within the past 6 months was suspected of glanders. The only sign upon which this suspicion was based was a painless, diffused, by no means characteristic swelling of the right submaxillary gland. There was no nasal discharge, no cough. The gland was removed, placed for 15 minutes in a $\frac{1}{10}$ per cent. solution of mercuric chloride, washed in alcohol and cut with flamed knives. In the substance of the gland were found two grayish-white soft foci as large as peas, not yet broken down. Cultures made by placing particles of these foci upon *agar* in tubes revealed the presence of glanders bacilli. The horse was killed, and at the autopsy ulcers were found on the septum, and the lungs were affected in a manner characteristic of the disease. The author rightly claims that without the aid of bacteriology the disease could not have been determined during life.

In the course of our inoculation experiments on guinea pigs, three submaxillary glands were examined and cultivations made:

In the first case the gland was as large as two hen's eggs. The gland substance was pale red. Cultures were made on *agar*, blood serum, and potato by cutting out small bits of the interior of the various lobes and rubbing these upon the culture medium, the surface of the gland being disinfected by scorching it. After the cultures had been made the gland was more thoroughly examined and a considerable number of yellowish-white spots as large as a pin's head were found, representing plugs of pus lodged in cavities. It is highly probable that some of these were transferred to the culture tubes in the pieces cut out. The tubes remained sterile, however, excepting one containing micrococci.

A second gland taken from a horse killed and found glandered was considerably swollen, the individual lobes as large as walnuts. The gland was placed in 5 per cent. carbolic acid for five minutes, then in $\frac{1}{10}$ per cent. mercuric chloride for one-half minute; finally sterile water was poured over it to remove the chloride.

The lobes were cut open with flamed knives and several cavities one-twelfth to one-eighth inch (2 to 3 millimeters) in diameter were found containing white, consistent cheesy masses. Potato and *agar* tubes inoculated with these masses remained sterile.

A third gland, which had been removed from a glandered colt at the autopsy, was examined and cultures made in the same way. The gland contained no caseous masses, and hence bits of tissue were cut out and placed on *agar* and potato tubes. Of five cultures all remained sterile but one. This contained a single colony not resembling the colonies of glanders bacilli and made up of actively motile bacilli.

So far as these experiments go, they can not be said to favor the method of diagnosis by extirpation of the submaxillary glands unless the result is only considered decisive when the bacilli of glanders have been actually found. They certainly can have little value when the result is negative.

NATURE AND PREVENTION OF HOG CHOLERA.

INVESTIGATIONS OF 1887.

An extensive outbreak of hog cholera near the city of Washington during the months of November and December, 1887, afforded the opportunity of examining more carefully the condition of the lungs in the various types of this disease as contrasted with swine plague or true infectious pneumonia. At the same time the bacteriological examination re-affirmed the constant presence of the bacillus described three years ago in genuine hog cholera and its causal relation to this disease. It is to be hoped that the rather stubborn and wholly unfounded position maintained in some quarters that there is no disease such as hog cholera independent of swine plague will be abandoned. This is the more important inasmuch as hog cholera is a more prevalent and more virulent disease than swine plague. At least five epizootics have been observed in the District of Columbia to one of swine plague. In order to combat any bacterial disease it is absolutely essential that all facts connected with the life history of the bacteria be taken into account, and this implies the frank acceptance of results of investigations if the evidence has been fully and unreservedly presented.

The history of the outbreak, as far as could be ascertained, was briefly as follows: On October 28, there were in all 119 swine, chiefly young pigs, weighing from 50 to 100 pounds. Most of these had been purchased in the city markets. At this same time 20 boar pigs were castrated. Within two weeks these began to die, and soon after the others took sick, dying at the rate of 3 to 4 a day. Less than three weeks after the first deaths only 67 remained out of the 119. At the end of the year only about a dozen were alive out of the entire herd. These may have acquired an immunity.

The animals were kept in pens on the top of a low hillock, sheltered from the weather by large boxes. They were swill-fed, and this may account for their feeble resistance to the disease. In most of them the feeding had induced a cirrhosis of the liver, with softening of the parenchyma. The origin of the disease could not be traced, as the animals had come from various quarters. The city markets had proved themselves the source of disease in several purchases of pigs for experimental purposes.

The autopsy and bacteriological notes will be given in the order in which the animals were examined, any general remarks being reserved for the end. The rapidity with which the animals succumbed to the disease made any very thorough examination quite impossible, since it seemed more desirable to utilize all the material by examining those organs most always diseased in hog cholera. Most attention was paid to the lungs and the digestive tract, while the lungs and the spleen

were the only organs examined bacteriologically. These notes will serve to supplement the autopsy notes in the reports for 1885 and 1886.

In making cultures from the spleen the following method was usually adopted. At the autopsy the abdomen was carefully laid open by first removing the skin and then cutting through the abdominal muscles with flamed instruments. The flaps laid back brought into view the spleen not touched as yet by any instrument. It was then drawn out with flamed forceps, severed from its attachments with flamed scissors and placed in a large bottle plugged with cotton wool which had been previously subjected to a temperature of 150°-160° C. for two hours. In this way it was taken to the laboratory and either immediately examined or kept in the refrigerator below 55° F. over night. In making cultures the spleen was placed on a sterile glass support and the surface thoroughly charred with a red-hot platinum spatula. This was always done, although seemingly unnecessary when we consider the momentary exposure to the air in transferring the spleen from the abdomen to the sterile bottle. It may, however, destroy any bacteria which have entered the peritoneal cavity through ulcers. Through this charred area an incision or rent was made and a platinum wire introduced, and then a tube of gelatine or beef infusion inoculated with it. When roll cultures were made a minute bit of spleen pulp was torn away from beneath the charred portion and stirred about in the liquefied gelatine. From this usually a second tube was prepared. Experience of past years has shown that frequently this is not sufficient to insure the fertility of the cultures. In chronic cases with the spleen but moderately enlarged, hog cholera bacteria are found in very small numbers. In such cases bits of spleen are cut out from the charred area with flamed scissors and transferred to tubes of gelatine or beef infusion with or without peptone. Such cultures rarely fail. It might be supposed that the chances of accidental contamination are very great in this process. But a long experience with spleens of healthy animals and with organs in the study of other diseases has demonstrated the entire safety of this procedure. Salmon culture tubes with bits of organs in the bottom covered by nutrient liquids have remained sterile for months in the laboratory. At present the Esmarch tube or roll culture is indispensable in such cases.

In nearly all the cases examined both liquid and gelatine cultures were made. The former permit a diagnosis on the following day, while the latter require at least two days, usually three or four, before a reliable diagnosis can be made. The cultures were always examined unstained in a hanging drop, as the bacteria in this way are not deprived of their power of motility, which is one of the important diagnostic characters. Staining cultures was also resorted to, but it adds little information to that gained by a careful examination of the hanging drop. When gelatine cultures were examined the bacteria were always mixed with some sterile beef infusion to bring out their motility.

In a number of cases rabbits were inoculated directly from lung tissue. A small bit, about one-half centimeter cube, was torn up with flamed forceps in a flamed watch-glass containing some sterile beef infusion, and the turbid fluid injected beneath the skin of the thigh. The syringe used was an ordinary hypodermic syringe carefully disinfected by 5 per cent. carbolic acid above and below the piston for one-half hour both after and before use, and each time thoroughly rinsed in boiling water. As hog cholera bacteria are destroyed by a

1 per cent. solution of carbolic acid in less than ten minutes, and by a momentary contact with water near the boiling point, the disinfection was certainly all that could be desired. This method was regarded as less open to criticism than the insertion of bits of tissue under the skin. We still stand in need of a syringe which can be disinfected without much trouble, as the above method is extremely tedious. The syringes devised by Koch are both unsatisfactory. The joints formed by the glass barrel and the metal cap in the syringe in which the propelling force is air were found to leak in five out of six samples. From the fluid injected into rabbits either plate or roll cultures were made in order to get an idea of the approximate number and the kind of organisms present. In every case the portion of lung tissue from which the inoculations were made was transferred to sterilized bottles and protected from accidental contamination as carefully as possible. Unless otherwise indicated, the methods just given were employed throughout the investigation.

November 16.—Pig No. 1 just died and brought to Experimental Station. No skin lesions; heart and lungs normal with exception of a few collapsed lobules in principal lobe of one lung.* In abdomen omentum injected so as to appear bright red. Spleen enlarged, soft, dark. Some lymphatics have the cortex hemorrhagic. Stomach and small intestines normal. In cæcum near valve several large superficial yellowish ulcers and a number of smaller ones, an eighth of an inch in diameter. Two bits of spleen were cut out and dropped into a tube of gelatine, and one of beef infusion. The gelatine culture remains sterile. The liquid culture contains the motile hog cholera bacteria and a large butyric bacillus growing only in the bottom of the liquid.

No. 2 died last night. Buzzards had eaten into the thorax and penetrated the coats of the stomach. Only the small ventral lobe of right lung diseased. Bright red, mottled with pale yellow dots. (See Plate V, fig. 2.) The smallest bronchi occluded by cylindrical plugs. Alveoli likewise occluded. The plugs consist chiefly of cells and are so dry and firm that they may be removed as small ramifications or branchings when the lung tissue is torn away. Bronchial glands enlarged, hemorrhagic. Spleen enormously enlarged, liver in advanced stage of cirrhosis. Glands at portal fissure chronically enlarged. In cæcum four superficial ulcers one-half inch across, slough stained yellow. In upper colon four similar to these and a large

*In order to understand the description of the lung lesions, the following brief outline of the anatomy of the lung and of the terms used may be of service:

The right lung is made up of four lobes; the left has only three. (In text-books on anatomy the left lung is considered as being made up of only two.)

In both there is a large principal lobe resting upon the diaphragm and against the adjacent thoracic wall. This lobe forms the major part of each lung. The remainder, occupying the anterior (or cephalic) portion of the cavity, is made up of two small lobes, one extending ventrally (or downward in the standing position of the animal) and in the expanded state covering the heart laterally, the other extending towards the head and overlapping the base of the heart. These small lobes may be denominated the ventral and cephalic lobes, respectively. The right cephalic lobe is longer and more distinct from the ventral lobe than the corresponding left cephalic. Wedged in between the two principal lobes and resting on the diaphragm is a small lobe, pyramidal, belonging to the right lung (azygos lobe). This lobe rests on the left against the mediastinal membrane, and on the right it is separated from the right principal lobe by a fold of the pleura passing from the ventral abdominal wall to inclose the inferior vena cava. This small lobe is almost completely shut off, therefore, from the other lobes by folds of the pleura.

number of small ones about one-eighth inch across with yellowish slough.

A moderate number of bacteria found in cover-glass preparations of spleen. A gelatine tube culture contained, after three days, about seventy-five to one hundred colonies of the motile hog cholera bacteria in each needle track. A liquid culture inoculated simply with the platinum wire thrust into the spleen pulp contained hog cholera bacteria only. A rabbit was inoculated from lung tissue as above described; about one-fourth of a cubic centimeter of the suspension injected. Dead on the seventh day. Slight fibrinous exudate on coils of intestines. Spleen very large, soft, dark. Beginning coagulation-necrosis in liver. Bacteria very numerous in spleen; both gelatine and liquid cultures contain only the motile hog cholera bacteria. The plate from lung tissue with which the rabbit was inoculated contains a very large number of identical colonies, made up of motile hog cholera bacteria.

November 17.—No. 3, male, died yesterday. Buzzards have consumed pectoral muscles and pierced into thorax and abdomen. Ecchymoses on costal pleura and entire epicardium, a few under pulmonary pleura. Left lung hypostatic, slight amount of whitish foam in trachea. Lung tissue otherwise entirely normal, neither hepatization nor collapse anywhere to be seen. Bronchial glands and those along posterior aorta with hemorrhagic cortex. Ecchymoses in the subcutaneous fatty tissue over entire ventral aspect of body, about one-eighth inch across, beneath peritoneum of abdominal muscles and of the entire length of small intestine, from the size of a pin's head to one-eighth inch. Congestion in patches in large intestine, no ulceration. Stomach and intestines contain a yellow liquid resembling the yolk of eggs. Spleen but slightly enlarged. Ecchymoses under serosa of liver. Cirrhosis moderate. A bit of spleen tissue dropped into a tube of beef infusion gave rise to a culture of hog cholera bacteria. In each needle track of a gelatine culture countless colonies of the motile bacteria appear.

November 18.—No. 4, medium-sized male, died this morning. Superficial inguinal glands enlarged, cortex slightly hemorrhagic. Some fibrils on coils of intestine. Petecchiæ under serosa of small intestine; extensive hemorrhage between mucous and muscular coat of stomach along fundus, forming a clot about one-half inch thick. Spleen very large, friable, blackish, extends beyond median line into right side. Petecchiæ on liver, which is considerably cirrhotic; mucosa of stomach along fundus blackish; closely set petecchiæ under mucosa of small intestine; contents liquid, blood-stained. A dark hemorrhagic patch near valve in large intestine. Colon studded with petecchiæ, no ulceration. Small number of petecchiæ on surface and throughout cortex of kidneys. No bacteria seen on a cover-glass preparation of spleen tissue. Beef infusion inoculated with a wire thrust into spleen remains sterile. A bit of spleen dropped into a tube of gelatine gives rise to about a dozen colonies of hog cholera bacteria.

November 18.—No. 5, male, 75 pounds, three to four months old, died last night. Inguinal glands enlarged, pale. Left cephalic, ventral, and about one-third of principal, right cephalic and ventral lobes of lungs solidified, bright red, mottled with minute yellowish dots, *i. e.*, same as No. 2. Costal pleura covered with a very thin whitish exudate. Solidified portion of principal lobe adherent. On epicardium a very delicate papery deposit. Spleen much congested.

Inflammatory adhesion of liver to diaphragm. Mesenteric glands nearly as large as hen's eggs, mottled, pale red. About twelve ulcers one-quarter to one-half inch across in lower ileum; base depressed and covered with a thin yellow layer; outline irregular; not connected with Peyer's patches. Valve thickened and ulcerated. Several ulcers in cæcum; a large projecting slough attached to one of them. A gelatine and a liquid culture from the spleen contain hog cholera bacteria only. A liquid culture from the pleura remains sterile.

A rabbit inoculated from the hepatized lung tissue died on the eighth day. Slight fibrinous exudate on intestines, diffuse coagulation necrosis in liver, spleen much congested. Immense number of hog cholera bacteria in spleen and liver. Cultures pure. A plate made from the same bit of (pig's) lung tissue contains about fifty colonies resembling hog cholera.

No. 6, large black male, died last night. Extensive sero-fibrinous infiltration of subcutis from axilla to pubis and over right thigh. The subcutis has a gelatinous aspect. Spleen much congested. Lungs normal. In cover-glass preparations from spleen large bacilli, with ends square. Cultures in gelatine and beef infusion remain sterile. Animal probably died of malignant œdema.

November 21.—No. 7, medium-sized male, died yesterday. Temperature of air varying from 26° to 50° F. Omentum deeply reddened. Spleen enlarged, soft; small hemorrhages under capsule one-eighth inch across. Liver imparts a sensation of grittiness when cut. Cortex of kidneys dotted with hemorrhagic points. The patch of mucous crypts about valve in cæcum dark, pigmented; no ulceration. Mucosa of stomach hemorrhagic in fundus. Thorax half full of blood-stained serum and some fibrin stretching from lung surface to walls; small quantity of fibrin in pericardial cavity. Lung tissue infiltrated with blood (pulmonary hemorrhage). Two ventral lobes collapsed; subpleural hemorrhagic patches. A cover-glass preparation from spleen contains numerous hog cholera bacteria. In each needle track of a gelatine culture, countless colonies. A liquid culture from a bit of spleen tissue contains hog cholera bacteria only.

No. 8, small female, died yesterday. Patches of skin on ventral aspect of limbs and groin reddened. Minute petechiae under serosa of ventral abdominal walls. Spleen very large, congested. Some delicate fibrils stretched over coils of intestine. Liver cirrhotic. Glands of mesentery and meso-colon enlarged; cortex hemorrhagic. Fundus of stomach moderately congested. In cæcum are black pigment spots resembling former hemorrhage, chiefly on the summit of folds. In upper colon ulcers about three to a square inch, each one-fourth inch in diameter, and covered by a convex, projecting yellowish slough. Ulcers found down to rectum. Small quantity of clear serum and a few fibrils in pleural cavities and pericardium. Left ventral and tip of right cephalic lobe collapsed. A gelatine and a liquid culture made from a bit of spleen tissue contain hog cholera bacteria and a butyric bacillus which slowly liquefies the gelatine.

No. 9, small male. Diffuse reddening of ventral aspect of body especially marked on limbs. Spleen, lymphatics, and kidneys normal. A small abscess in pelvis attached to bladder, probably caused by castration. Venous congestion of vessels of meso-colon. The transverse folds of mucosa of colon covered by very thin yellowish patches of necrosis. Feces hard, distending the large intestine. Cephalic

and ventral lobes of left lung solid, plainly mottled. The bronchioles and alveoli filled with consistent plugs of cellular exudate. Remainder of lungs normal. Owing to small size of spleen, two liquid cultures were made, each with a bit of spleen tissue. In both, hog cholera bacteria alone appeared. A rabbit inoculated with hepatized lung tissue remains well for weeks after. A plate culture therefrom is liquefied in two days.

No. 10, small castrated male, died yesterday. Has been sick for some time according to overseer of farm. Spleen not enlarged. Inflammatory changes in pelvis due to castration. Stomach slightly reddened and bile-stained. One large ulcer on ileo-cæcal valve one-half inch across, black, with yellowish margin. A few very superficial ulcers in cæcum. Lungs normal, left somewhat hypostatic. Two cultures made with bits of spleen contain both hog cholera bacteria and butyric bacilli.

No. 11, dying, killed by being bled from brachial vessels. Lungs normal. Spleen small. Liver slightly cirrhused. Two ulcers in cæcum; slight superficial necrosis in colon. A liquid culture made from a bit of spleen contains hog cholera bacteria on following day.

November 23.—No. 12, small white male, died yesterday. Median line of ventral aspect of body much reddened, limbs slightly so; extravasation under skin and into muscular tissue over sternum. Much blood-stained serum in peritoneal cavity; spleen very large, dark. In kidneys, cortex and base of pyramids deeply reddened. In cæcum, slight traces of superficial necrosis. Anterior and cephalic lobes of both lungs collapsed. Blood-stained serum in pericardium. Numerous hog cholera bacteria on cover-glass preparations of spleen pulp. In a gelatine culture from the spleen countless colonies appear in each needle track. A liquid culture made with platinum wire contains hog cholera bacteria on following day. A rabbit inoculated from the collapsed lung tissue died on the tenth day. Spleen engorged; numerous foci of coagulation-necrosis in liver, involving each one or more acini; extensive necrosis along border of left lobe. Ecchymosis of pyloric valve and duodenum; hemorrhagic foci in lungs, about fifteen in each lung, one-eighth inch to three-sixteenths inch in diameter. Examination of the spleen shows numerous hog cholera bacteria. A gelatine culture contains countless colonies in each needle track.

No. 13, small female, died yesterday. Skin on ventral aspect of limbs and over pubis reddened. Spleen greatly enlarged, congested. Lungs normal. A few lobules in ventral and right cephalic lobe collapsed. Liver slightly cirrhused. Stomach distended with food. Large patch of mucosa in fundus reddened. Cæcum and colon contain numerous ragged depressed ulcerations. Valve entirely encircled by ulceration. Contents of intestine liquid, yellow. A gelatine and a liquid culture inoculated with a platinum wire thrust into spleen remain sterile. No bacteria seen in cover-glass preparations.

No. 14, small female, weight about 50 pounds. Considerable reddening of the skin over ventral aspect of body and limbs; especially marked along median line. Superficial inguinals enlarged, of a mottled pale and deep red on section. Spleen very large, 12 inches long, 2 inches broad, and five-eighths to three-fourths inch thick at hilus; gorged with blood, friable. A small number of punctiform hemorrhages in cortical portion of kidneys. Glands of mesentery and of colon enlarged and congested. Deep reddening of several square

inches of mucosa in fundus of stomach. Large intestine contains a semi-liquid mass, chiefly earth. Four large ulcers in cæcum, one of them at least 1 inch across, covered by a yellowish slough; the peritoneum covering it is thickened and inflamed. In upper colon there is considerable necrosis, involving the epithelium in patches. Lungs normal, excepting the right ventral lobe, which is solid. Bronchi and air cells of this lobe completely occluded by plugs as with No. 2; surface bright red, mottled with yellowish points—the ultimate air cells filled with the cellular exudate. Subpleural ecchymoses over both lungs. From the spleen a liquid and a gelatine culture contained only hog cholera bacteria. They were very numerous in cover-glass preparations from this organ.

A rabbit inoculated from the consolidated lung tissue died on the seventh day. At the point of inoculation a pasty mass extends to abdomen, only subcutis involved. Spleen engorged. Single acini and groups in the liver are completely necrosed, yellowish white. In both organs hog cholera bacteria. Cultures from spleen pure.

November 25.—No. 15, black and white male, died yesterday morning. Redness of skin of abdomen, throat, and limbs. Superficial inguinals hemorrhagic. Spleen very large, gorged with blood. Lungs normal, excepting a few lobules at the caudal border of principal lobes, which are red, collapsed, and contain lung worms. Pericardium contains deep-colored serum and coagula; left auricle dotted with petecchiæ. Bronchial lymphatics hemorrhagic. Liver slightly cirrhotic. Cyst in right kidney one-half inch in diameter. Fundus of stomach intensely congested, similarly the cæcum and colon; no ulcers. Lymphatics of meso-colon hemorrhagic. A beef-infusion culture from a bit of spleen contains the motile hog cholera bacteria only. A gelatine culture became liquefied by the heat of the laboratory; no bacteria seen on a cover-glass preparation of spleen.

No. 16, black and white female, died last night. Skin and spleen as in previous case. The small ventral lobe of both lungs collapsed, lungs otherwise normal. Liver in advanced stage of sclerosis; stasis of portal circulation. Lymphatics of abdomen as in No. 15. Fundus of stomach slightly reddened; one ulcer three-fourths inch across. Extensive necrosis of mucous membrane in colon and rectum, slight in cæcum; wherever the membrane is free from a slough it is deeply congested. Numerous hog cholera bacteria and some large (butyric) bacilli in spleen. A beef infusion and a gelatine culture contain them. From a bit of collapsed lung tissue a plate culture is made and a rabbit inoculated. The plate contains in two days about six to seven liquefying and a large number of non-liquefying colonies, the latter made up of motile hog cholera bacteria; the rabbit died on the seventh day. Spleen very large, friable; contains large numbers of hog cholera bacteria. On left lobe of liver an area of necrosis one-fourth inch by three-fourths and one-sixteenth inch deep. On the right lobe only three or four acini necrosed. Pylorus and duodenum covered with hemorrhagic dots and patches. Culture from spleen pure.

November 26.—No. 17, female of medium size; died suddenly this morning without previous illness. Subcutaneous fat abundant. Spleen moderately congested. Petecchiæ in cortical portion of kidneys. Fundus of stomach slightly reddened. In lower ileum patches of congestion. Scattered petecchiæ in mucosa of large intestine; contents normal. Glands of mesentery and meso-colon with cortex hemorrhagic. Large quantity of blood-stained serum in thorax. Fi-

brinous deposit on pleura; lungs partly expanded; cephalic half of right lung solid, blackish; air-tubes and alveoli filled with extravasated blood. Interlobular tissue distended with blood-stained serum (pulmonary hemorrhage). Left lung in the same condition. Trachea full of reddish foam. Blood and fibrinous coagula in pericardial cavity. Beef infusion, into which a bit of spleen was placed, remains sterile; also a tube of gelatine inoculated from the spleen with platinum needle. In a cover-glass preparation of the spleen large (butyric?) bacilli.

No. 18, small female, died last night. Buzzards have consumed thigh muscles. Diffuse reddening along median line of abdomen. Hemorrhagic spots one-eighth to one-fourth inch across, subepidermal, chiefly on ventral aspect of limbs; subcutaneous and subperitoneal ecchymoses. All abdominal lymphatics with cortex infiltrated with blood. Serosa of large intestines as if sprinkled with fresh blood; several subserous hemorrhagic spots one-half inch across on diaphragm, along inferior vena cava, common bile duct, and gall bladder; also under mucosa of the whole length of small intestine, throughout cortical portion and between pelvis and medullary portion of kidneys. Fundus of stomach one mass of petecchiæ and larger extravasations. One ulcer in cæcum, old, with indurated base. Valve and the patch of mucous crypts at its base ulcerated; depth of ulcer indurated, consisting of a tough, pale tissue. Small old ulcers in upper colon. Lungs dotted with small hemorrhages, chiefly subpleural. Three or four hemorrhagic patches under costal pleura of each side. Lung tissue normal, excepting the base of right ventral and the tip of left ventral lobe, which are collapsed. Hemorrhages under epicardium over entire heart; left auricle one mass of ecchymoses. Coagula of fibrin in auriculo-ventricular groove.

Through an oversight the cultures from this animal and the one following were both numbered the same, so that it was impossible to identify them. A liquid culture from each was made by adding a bit of spleen tissue. A gelatine culture from each was made simply with platinum wire. One tube of infusion contains hog cholera and butyric bacteria; one tube of gelatine contains immense numbers of hog cholera colonies. The other two tubes remain sterile. A rabbit inoculated from the collapsed lung tissue remained well for a month after. A plate culture from the same contained about six colonies, evidently of hog cholera bacteria.

No. 19, small male, died last night. Diffuse reddening on abdomen along median line. Superficial inguinals very large, pale, cedematous; peritonitis; feeble adhesion of coils of intestine to ventral wall and of lobes of liver to one another. Slight fibrinous deposit on intestines. Liver sclerosed. Lymphatics hemorrhagic. Cortex of kidneys dotted with extravasations. Mucosa of large intestines of a dark slate color; it is dotted with closely-set conical elevations, tough, whitish, about one-eighth inch high and one-sixth across. When scraped away a depressed pale pink, sharply-outlined spot remains. Microscopic examination of the intestine showed that these elevations correspond to amorphous masses, which failed to become colored on applying the ordinary staining agents. They covered portions of the mucosa which were either wholly or partially necrosed and incapable of being stained. In some places the outline of the tubules could still be discerned. On applying Weigert's fibrin stain, long meshes of fibrin corresponding in general to the outline and position of the destroyed tubules appeared. Valve thickened and completely

covered by ulceration. Cephalic half of both lungs airless, affected with broncho-pneumonia; catarrhal exudate filled alveoli and air tubes. Epicardium dotted with hemorrhagic points. Slight, feeble, pleural adhesions.

For cultures from spleen, see No. 18. A rabbit inoculated with lung tissue died on the fifth day. Spleen slightly enlarged; contains many hog cholera bacteria. Gelatine culture contains very many colonies of the same.

No. 20, a large female. No skin lesions; a few strings of coagula over coils of intestine; spleen small; base of pyramids of kidneys much reddened; ileum dotted with subperitoneal hemorrhagic points and patches; mucosa not affected; mesenteric glands with cortex hemorrhagic. Large intestine empty, scattered ulcers one-eighth to one-fourth inch across. Liver sclerosed.

A beef-infusion culture inoculated with a bit of spleen tissue contains hog cholera bacteria and butyric bacilli. A gelatine tube culture contains a few hog cholera colonies.

November 29.—No. 21, small Jersey red, female, died last night. Skin deeply reddened along median line of abdomen. Large quantity of blood-stained serum in peritoneal cavity. Serosa of ileum and the mesentery completely covered with hemorrhagic points and patches. Lymphatics of abdomen hemorrhagic throughout their substance. Petecchiæ in cortex of kidneys. Mucosa in fundus of stomach hemorrhagic. Mucosa of lower ileum a confluent layer of necrosed tissue. Numerous round ulcers in cæcum and colon; slough projects slightly. Lungs hypostatic, interlobular spaces distended with coagulated blood, most marked in dependent lobes. Simple collapse of both ventral lobes and of the right principal near the root. Ventricles of heart dotted with petecchiæ, auricles black, covered with clotted extravasated blood. Hog cholera bacteria present in cover-glass preparations from spleen and in both gelatine and liquid cultures.

No. 22, male, Jersey red, died last night. Glands of abdomen with cortex infiltrated with blood. Spleen engorged. A few hemorrhagic patches in fundus of stomach. In cæcum and colon ulcers about three-eighths inch across; very thin, adherent, yellowish slough. About one ulcer to 4 square inches of surface. Considerable blood-stained serum in pleural cavities, hemorrhage in anterior half of left lung, which is solid, blackish on section. Clots and reddish foam in trachea and bronchi; hemorrhage seems somewhat older than in No. 21. Pleura of right lung roughened and parts adherent to chest wall. Ventral lobesolid, bronchioles firmly plugged with dry catarrhal secretion. Hog cholera bacteria on cover-glass from spleen pulp and in a gelatine and liquid culture made therefrom; only five to ten colonies in each track of the platinum wire. A rabbit was inoculated from a bit of the solidified lung tissue and a plate culture made. The latter develops numerous colonies of hog cholera bacteria. The rabbit died on the thirteenth day. Numerous hog cholera bacteria in both organs. A gelatine culture from the spleen contains the same organisms.

No. 23, small black male. Buzzards had removed pectorals of one side. Lymphatics congested, not hemorrhagic. Crowded petecchiæ in subcutis and beneath peritoneum of ventral abdominal wall. Spleen very large, congested. Four or five small hemorrhages on diaphragm. Mucosa of cæcum and upper colon ulcerated in large patches. In lower colon the ulcers are small, yellowish, depressed areas embedded

in a very dark mucosa dotted with numerous punctiform ecchymoses. At root of left lung there is some collapse, extending slightly into all lobes. Of right lung the ventral and cephalic lobes are collapsed, with occasional emphysematous lobules interspersed. Lungs otherwise normal. Extensive hemorrhage of both auricles in the form of diffuse patches and petecchiæ. A gelatine and a liquid culture from the spleen remain sterile. A plate culture made from a bit of collapsed lung tissue contains a considerable number of colonies, which are made up of bacteria resembling those of hog cholera, but differing from them in their manner of growth on gelatine, in beef infusion, and in the absence of motility. A rabbit inoculated from the same bit of lung tissue remains well. A plate culture from a bit of normal tissue from the same lung contains but one colony.

No. 24 died yesterday; medium-sized female. Spleen very large, extends beyond median line. Lungs normal, excepting collapse of a small portion of the right ventral lobe. Lymphatic glands in general with hemorrhagic cortex. Cæcum and colon very much congested, ulceration superficial and slight. Entire fundus of stomach of a uniform deep wine color. A gelatine and a liquid culture from the spleen contain only motile hog cholera bacteria. In the former the colonies are very numerous. The bacteria are demonstrated in cover-glass preparations from spleen pulp.

No. 25, medium sized black male, died yesterday. Spleen very large. Subperitoneal tissue full of petecchiæ. Lymphatics with hemorrhagic cortex. Hemorrhages under serosa of duodenum and common bile duct. Valve completely ulcerated. Intestine otherwise normal and feces dry. Lungs contain a large number of subpleural hemorrhages; parenchyma normal; epicardium hemorrhagic. Kidneys contain a specimen of kidney-worm (*Sclerostoma pingvicolæ*). A gelatine and a beef infusion culture from the spleen became confused with those of another pig (No. 435), to be described later on. One set of cultures remained sterile; the other contained hog cholera bacteria. In all probability the sterile cultures belonged to this animal.

December 2.—No. 26, medium-sized female, died last night. Considerable redness of skin over the ventral aspect of limbs and along median line of abdomen. Spleen very large, blackish. Several strong fibrous adhesions between costal and pulmonary pleura. Lung tissue normal. Left kidney contains a small cyst. Large number of round depressed ulcers stained yellow, most numerous in cæcum. One ulcer is one-half inch across, the inflammation extending to serosa. Stomach very dark, pigmented along fundus. On a cover-glass preparation from spleen numerous large bacilli (probably butyric). They did not develop in the liquid and gelatine culture, which latter contained only hog cholera bacteria colonies, very numerous in each needle track.

No. 27, small black male. Superficial inguinals enlarged, pale, œdematous. Superficial ulceration and hemorrhagic changes in cæcum. Lungs normal. *Post mortem* changes too advanced for cultures.

No. 28, small female, died last night. Superficial inguinals with cortex hemorrhagic. Spleen slightly enlarged. Minute hæmatomata on its surface. Slight sclerosis of liver. Left kidney contains six cysts one-half inch diameter. Stomach in fundus somewhat congested. In large intestine, ulcers one-quarter to three-eighths inch diameter, with adherent yellowish, projecting slough, most numerous

in cæcum. About one-third of the ventral lobe of each lung and a few lobules of the right principal lobe collapsed. Lungs otherwise normal. In a beef infusion culture from the spleen both hog cholera and butyric bacteria were present. A gelatine culture contained but two colonies. From a bit of collapsed lung tissue a plate culture was made and a rabbit inoculated. On the plate about fifteen colonies of hog cholera bacteria appeared. The rabbit died on the fifteenth day. Bare indications of necrosis in liver. Spleen very large. Both organs contain a moderate number of hog cholera bacteria. A roll culture from the spleen is pure.

No. 29, large black male, died about thirty-six hours ago. Temperature below freezing point. Skin deeply reddened over entire ventral aspect of body. Superficial inguinals enlarged, slightly congested. Spleen very large (about 14 inches long), very soft and friable. Slight sclerosis of liver and old perihepatitis. Retro-peritoneal glands with cortex hemorrhagic. Cyst in right kidney. Slight ecchymoses in fundus of stomach. Valve and patch of mucous glands in cæcum very dark with pigment. Slight superficial ulceration in cæcum and upper colon. Lungs and heart normal. Both gelatine and beef infusion cultures contain hog cholera bacteria. In the former the colonies are very numerous.

No. 30, small black male, died thirty-six hours ago. No reddening of skin. Superficial inguinals and spleen but slightly enlarged. Peritonitis. Petecchiæ under serosa of small and large intestines and bladder. Moderate amount of fibrinous exudate. Valve completely ulcerated, ulcer deep. One near valve has caused thickening of serosa of intestinal wall. In cæcum an extensive patch of ulceration; in colon a few ulcers and numerous punctiform hemorrhages. Right lung completely adherent to costal pleura by means of fibrous tissue. A small ventral portion of principal lobe of left lung is airless, pale red, mottled with yellowish points. Air tubes and vesicular portion occluded with dry cylindrical plugs. A culture in gelatine from the spleen develops numerous colonies in each track of the wire. A liquid culture contains the butyric bacillus also. A bit of the solidified lung tissue was used for a plate culture and to inoculate a rabbit. The plate developed countless colonies of hog cholera bacteria as tested by other cultures. The rabbit died on the tenth day. The spleen was enlarged, the liver full of centers of advanced necrosis, involving one to three acini; hog cholera bacteria very numerous in both organs.

December 3.—No. 31, small black and white female, died yesterday. Well marked odor of decomposition. No skin discoloration. Spleen but slightly enlarged. Lymphatics in general with hemorrhagic cortex. Liver in state of advanced sclerosis. Stomach normal. A few large old ulcers and a considerable number of small ones throughout cæcum and colon. Mucosa itself pigmented with patches of fresh congestion. Lungs normal. A liquid culture from the spleen contains only butyric bacilli.

No. 32, small black and white female. No skin discoloration. Lymphatics, including inguinal, bronchial, and peritoneal with more or less hemorrhagic cortex. Spleen engorged. Liver sclerosed. Kidneys with numerous petecchiæ throughout cortical portion. Stomach pale. Several large old ulcers in upper colon. Cæcum and colon pigmented. Lungs normal with exception of a few collapsed lobules in ventral lobes. Both a gelatine and a beef infusion culture contain hog cholera bacteria. Colonies very few.

No. 33, large black and white male; said to have died last night. Advanced *post mortem* changes. No examination made, excepting to see the condition of lungs, which were healthy.

No. 34, medium-sized white, died last night. Considerable reddening over ventral aspect of body. Inguinals reddened on section. Small quantity of dark-colored serum and numerous yellowish flaky coagula attached to abdominal organs. Spleen very large, dark, friable. Liver cirrhotic. Kidneys with cortical portion thickly dotted with petecchiæ, hemorrhage into pelvis. Lymphatics in abdomen with cortex more or less hemorrhagic. Extensive and deep ulceration in large intestines; in cæcum and upper colon as large patches, in lower colon as small ulcers. The mucosa which is not destroyed is deeply congested. Stomach along fundus deeply reddened. Extensive fibrous adhesions of left lung to walls of thorax. Collapse involves ventral, cephalic, and portions of principal lobe of right lung, and small portion of principal and ventral lobe of left lung. Extensive muco-purulent secretion in trachea, bronchi, and subdivisions throughout both lungs. Bronchial glands with cortex hemorrhagic. A beef infusion culture from the spleen contains hog cholera and butyric bacteria. In the gelatine culture each track of the wire contains countless colonies of what are shown under the microscope to be motile hog cholera bacteria. From a bit of collapsed lung tissue a plate culture was made and a rabbit inoculated. The plate develops countless non-liquefying colonies. The rabbit died on the eighth day. Spleen enlarged. Liver infested with coccidia. A slight amount of coagulation-necrosis. Hog cholera bacteria in both organs and in cultures from the spleen (both gelatine and liquid).

December 5.—No. 35, small black and white female, died yesterday. Redness of skin over abdomen and inside of limbs. Spleen enlarged, slightly congested. Lymphatics with cortex infiltrated with blood. Large quantity of blood-stained serum in abdomen. Liver sclerosed. A few scattered petecchiæ in cortical portion of kidneys. Mucosa of colon pigmented; a few small ulcers present. Lungs normal, with exception of a few collapsed lobules in ventral lobe of each lung. Dark-colored serum in pericardial cavity. The spleen contains large numbers of butyric bacilli. A liquid culture contains both hog cholera and butyric bacilli. A gelatine culture remains sterile.

No. 36, large black and white female, died yesterday. Lungs normal. Spleen very large, dark, friable. Liver sclerosed; lymphatics generally with cortex congested or hemorrhagic. Large number of ulcers in cæcum and colon; mucosa deeply congested. From spleen countless colonies of hog cholera bacteria in a gelatine tube culture. In a liquid culture the butyric bacilli are also found.

No. 37, medium Jersey red and the last of a lot of seven, dead forty-eight hours. This animal has been sick for some time; the spleen was very large, gorged with blood. Lymphatics pale. Large number of old ulcers, from one-sixteenth to 1½ inches across in cæcum and colon; mucous membrane generally pale. Of the lungs, both ventral and a small portion of cephalic lobes with smaller bronchi and alveoli plugged with dry catarrhal products. A liquid culture from the spleen contains hog cholera and butyric bacilli. A gelatine culture contains countless colonies. The spleen pulp on cover-glass preparations shows many. From the diseased lung tissue a rabbit was inoculated and a plate culture made. The latter de-

velops a large number of colonies of hog cholera bacteria. The rabbit died on the eighth day. Spleen enlarged and friable, contains many hog cholera bacteria. Slight coagulation-necrosis in liver, which is infested with coccidia. Cultures from blood and spleen pure.

December 7.—No. 38, small white female, died last night. Much emaciated. Subcutaneous and subperitoneal tissue contain numerous extravasations. Lymphatics in general with hemorrhagic cortex. Spleen moderately congested. Lung tissue normal. Numerous subpleural and epicardial hemorrhages. Kidneys with cortical portion dotted with numerous punctiform extravasations. Mucosa of small intestine contains numerous petecchiæ. One ulcer, one-half inch across, in lower ileum. Extensive and deep ulceration throughout whole length of large intestine. Some of the ulcers over 2 inches across; surface coal-black; the inflammation extending through the intestinal walls to serosa, which is dotted with scattered extravasations. A gelatine tube culture from spleen pulp contains countless colonies in each needle track, consisting, as seen under the microscope, of motile hog cholera bacteria. A liquid culture contains also streptococci and butyric bacilli.

No. 39, black and white female, *post mortem* changes under way. No examination made beyond ascertaining that lungs are normal, lymphatics with cortex infiltrated with blood, and spleen enlarged and congested.

December 8.—No. 40, small black female, died this morning. Superficial inguinals enlarged but pale. Moderate quantity of straw-colored serum in abdominal cavity. Spleen enlarged, deeply congested. In cæcum and upper colon a large number of deep broad ulcers; in some the inflammation extends through intestinal wall to serosa. In lower colon, ulcers small and mucosa deeply congested. Numerous hog cholera bacteria in spleen as shown by a gelatine culture. A liquid culture contains also butyric bacilli.

No. 41, small black and white female, died yesterday. *Post mortem* changes under way. Large quantity of blood-stained serum in abdomen. Plastic peritonitis matting together the various organs; spleen enlarged and congested. Numerous old ulcers in cæcum and colon, with adherent slough. Adhesive pleuritis, with large quantity of blood-stained serum in thorax. Lungs normal, excepting areas of collapse in ventral and cephalic lobes. A liquid culture from spleen contains both hog cholera and butyric bacilli. A gelatine tube culture develops a large number of colonies in each needle track.

December 10.—No. 42, small black and white male, died yesterday morning. No discoloration of skin. Spleen very large, congested. Lymphatics with cortex slightly reddened. Liver cirrhotic. A few extravasations in pyramids of kidneys. Mucosa of cæcum and upper colon covered with ulcers, the adherent slough dirty yellowish. Fully one-half the area of membrane thus involved, the remainder is pale. Lungs normal. From the spleen, hog cholera as well as butyric bacilli appeared in a beef-infusion culture. In a tube of gelatine the colonies were very numerous.

December 12.—No. 43, small black and white male, died December 10. No discoloration of skin. Spleen very large, friable, gorged with blood. Inguinals and lymphatics at lesser curvature of stomach hemorrhagic throughout. Those of mesentery and meso-colon less so. A few petecchiæ on surface of kidneys. Liver slightly cir-

rhosed. Mucosa of cæcum pale, of colon considerably congested. A few small ulcers with hemorrhagic border. Mucosa in fundus of stomach deeply congested. Slight hemorrhage in principal lobe of each lung, otherwise both normal. Bronchial glands hemorrhagic. Hog cholera bacteria quite abundant in spleen, as shown by cover-glass preparations and cultures.

December 15.—No. 44, medium-sized white female, died yesterday morning. Slight reddening of skin along median line of abdomen, limbs, and throat. Spleen enlarged and engorged. Inguinal, bronchial, retro-peritoneal, and meso-colic glands with cortex hemorrhagic. Liver badly cirrhotic. In cæcum one ulcer an inch across, involving entire thickness of wall, and a few smaller ones. A few in upper colon. Lungs oedematous. At least one-half of each lung (most dependent portion) airless, of a red flesh color. Sprinkled through it in some places more densely than in others are grayish-yellow areas one-half to two millimeters in diameter. Trachea full of foam. Bronchi contain a thick mucous secretion, most abundant in the diseased region. A roll culture from the spleen contains numerous colonies of hog cholera bacteria. From a bit of lung tissue a rabbit was inoculated; a plate culture from the same shows a very large number of colonies, probably hog cholera. The rabbit died on the seventh day. Spleen enlarged. Coagulation necrosis in liver, which also contains coccidia. Hog cholera bacteria numerous in spleen, as shown by cover-glass preparations and roll cultures.

No. 45, large black and white female, died December 13. Slight reddening of skin. Spleen large, congested. Lymphatics in general with cortex hemorrhagic. Liver badly cirrhotic; surface dotted with hemorrhagic points. Kidneys on surface and on section, as well as mucosa of cæcum and upper colon, dotted with numerous petecchiæ. No ulceration. Large quantity of blood-stained serum and coagula in pleural sacs, chiefly in the right. Lungs not collapsed, infiltrated with a reddish serum; left hypostatic. Abundant mucous secretion in bronchi and smaller air tubes stained with blood. No hepatization. Roll culture from a bit of spleen contains a large number of colonies of hog cholera bacteria. The same may be seen in cover-glass preparations from the spleen itself.

No. 46, Large black and white male, died December 13. Spleen enlarged and congested. Abdominal lymphatics with cortex more or less congested. Liver slightly cirrhotic. One large ulcer on valve about 1 inch across; several half as large in the middle of colon. Mucosa deeply congested in cæcum and colon; much pale serum in pleural sacs. Lungs slightly oedematous. Of right lung the principal near root, ventral and tip of cephalic airless, collapsed. One lobule on ventral (diaphragmatic) surface of principal lobe airless, with faint catarrhal injection of bronchioles and alveoli; of left lung a small portion of the principal collapsed; the ventral and cephalic emphysematous. The trachea, bronchi, and branches contain a large quantity of a translucent viscid mucus; no lung worms present. Bronchial glands enlarged, pale; those on posterior aorta with cortex hemorrhagic. Extravasations beneath epicardium. A plate culture from a bit of lung tissue develops about seventy-five colonies of hog cholera bacteria. A rabbit inoculated from the same bit remains well. A roll culture from the pig's spleen contains about fifty colonies alike; one examined is made up of motile hog cholera bacteria.

December 17.—No. 47, small female, died yesterday. Superficial inguinals entirely hemorrhagic. Mesenteric glands slightly con-

gested. Spleen barely congested. Mucosa of lower ileum completely ulcerated. Similarly that of cæcum and upper colon, but more severely so as to make the intestinal wall very friable. In lower colon the ulcers are isolated. Lungs and heart normal. In a roll culture from a bit of spleen tissue about one hundred colonies of hog cholera bacteria appeared.

No. 48, medium-sized black and white female, died last night. Superficial inguinals enlarged, pale. Abdominal lymphatics in general with cortex hemorrhagic. Spleen congested; surface covered with numerous elevated blood-red points. Liver extensively cirrhotic. Mucosa of ileum dotted with petechiæ. It contains about fifteen ulcers, not limited to Peyer's patches, with longer diameter transverse, in some cases encircling the tube. The ulcer is covered by a thin, yellow slough. One ulcer, one-half inch across, in cæcum, and two in colon. About one-half pint of straw-colored serum and a mass of semi-gelatinous pale coagulum the size of a fist in each pleural sac. Lungs but partly collapsed, pleura slightly roughened. Interlobular tissue of dependent lobes distended with serum, parenchyma oedematous, so as to sink in water. Bronchi contain a slight amount of reddish fluid. In a roll culture from a bit of spleen pulp about two hundred colonies of hog cholera bacteria appear.

December 24.—No. 49, large, black and white. Spleen gorged with blood. Lymphatics generally pale; liver cirrhotic. Cæcum and colon with walls thickened and very friable; mucosa entirely ulcerated. One ulcer in rectum. A roll culture from the spleen melted, but found to contain on examination only hog cholera bacteria.

DISEASE IN HEALTHY PIGS CAUSED BY MATERIAL FROM THIS EPIZOOTIC.

November 21.—Two pigs (Nos. 434, 435), about two months old, fed with spleens from several of the preceding cases. Two days later a few more spleens were given them. Both became sick a few days later and died November 28, about twelve hours apart.

No. 434. Spleen slightly enlarged, full of blood. All glomeruli of kidneys show as hemorrhagic points; lymphatics moderately congested. Stomach along entire fundus deeply congested. Superficial small ulcers in cæcum and colon; in the cæcum they are covered by a projecting slough. Right ventral and cephalic lobes collapsed, the former developed into broncho-pneumonia (catarrhal injection of small air tubes and alveoli). A few lobules of left principal lobe in the same condition. Hog cholera bacteria in the spleen as determined by a gelatine and a liquid culture. A rabbit was inoculated with a bit of lung tissue and a plate culture made. This developed countless colonies, non-liquefying, alike, shown to be motile hog cholera bacteria. Rabbit dies on sixth day. Spleen moderately congested; contains many hog cholera bacteria. In liver, minute foci of necrosis. A gelatine culture from the spleen contains numerous colonies of hog cholera bacteria.

No. 435. Spleen enlarged, covered with hemorrhagic elevations. Kidneys hemorrhagic as in No. 434. Stomach near pylorus deeply congested. Cæcum and entire colon covered with a dirty yellowish and blackish slough. Right and left ventral lobes, a small portion of right principal and left cephalic affected with broncho-pneumonia. Cultures from the spleen of this animal were confused with those of

another pig (No. 25), but one set remained sterile; the other contained hog cholera bacteria, and it is highly probable that the fertile cultures belonged to this animal.

A few additional cases are cited to show the infectious nature of this outbreak.

Nos. 436 and 437 were placed, November 27, in the infected pen containing the two preceding animals. They were also fed portions of hog cholera viscera later on. No. 436 was found dead December 27. Red blotches on skin of ventral aspect of body. Superficial inguinals hemorrhagic. Other lymphatics enlarged but pale. Spleen slightly congested. Mucosa of cæcum and colon deeply congested and dotted with considerable number of small ulcers. A roll culture from the spleen melted, but contains only hog cholera bacteria according to microscopic examination. No. 437 did not take the disease.

Nos. 449 and 452, placed in the same pen December 17, but not fed with infectious matter, died December 29. The lesions were somewhat different from those usually found, and are briefly as follows:

No. 452. Spleen and lymphatics not enlarged. Large quantity of serum and fibrinous coagula in abdomen. Viscera generally agglutinated. Lungs glued to chest wall by a recent exudate. Pericardium distended with serum and coagula. Lung tissue not affected. Kidneys deeply reddened. Mucosa of cæcum and colon entirely covered with a thin layer of diphtheritic exudate; when scraped away a deeply reddened surface is exposed. Numerous small, deep ulcers present. A roll culture of spleen, also melted from the heat of laboratory, contains only hog cholera bacteria. In No. 449 the lesions were the same, excepting the pericarditis. The ulceration of large intestine less extensive.

Two very instructive cases of hog cholera were caused by simply exposing pigs on an infected asphalt floor in a pen adjoining cases of the disease.

Nos. 464 and 466, about three and one-half months old, exposed with six others January 4.

No. 464 died January 11. Superficial inguinals normal. Those in abdomen much tumefied and hemorrhagic throughout. Spleen enlarged, friable, with hemorrhagic points. Several patches of mucosa in fundus of stomach one-fourth to one-half inch across, covered with blood clots. In large intestine only a few scattered petechiæ on mucous membrane. Some subpleural hemorrhages in lungs; lung tissue normal. Scattered petechiæ on epicardium of auricles and ventricles. On cover-glass preparations from spleen pulp a moderate number of bacteria were present. In several roll cultures only colonies of hog cholera bacteria appeared.

No. 466 died January 13. Skin of ears, throat, nose, limbs, and belly deeply reddened. Spleen as in No. 464. A few petechiæ on epicardium. Kidneys as in No. 464. Urine contains blood. The mucosa of large intestine in general deeply congested and studded with about fifty ulcers one-fourth inch across. Meso-colic and retro-peritoneal lymphatics with cortex hemorrhagic. Stomach as in No. 464. Lungs normal, excepting collapse of two-thirds of ventral lobes. Roll cultures from a bit of spleen pulp gave the same result as in preceding case.

BRIEF SUMMARY OF THE IMPORTANT FEATURES OF THIS EPIZOOTIC.

The high percentage of mortality in epizootics of hog cholera like the foregoing is the first thing to claim our attention. Out of 119 animals not less than 100 perished in the brief space of two months, or over 80 per cent. As no disinfection was resorted to, and no isolation of the healthy attempted, it is difficult to say what number could have been saved. At any rate the above figures indicate the mortality of this disease when left to itself, and it shows that nearly all young animals, such as weigh between 50 and 100 pounds, are susceptible to this disease.

Most of the animals died rather unexpectedly. Only a comparatively small number were visibly diseased some time before death. Since in many there was more or less ulceration in the large intestine, it indicates that animals may be in a very bad condition and become a source of infection for others without showing it.

The swill feeding has already been mentioned as a probable cause of the cirrhosis of the liver observed in so many of these animals. This organ was tough and imparted a gritty sensation to the hand when cut. The parenchyma was softened and degenerated. It seems reasonable to suppose that this chronic malady may have made the herd far more susceptible to the disease, and more especially to the acute hemorrhagic type.

Hemorrhagic lesions.—At least one-third of the cases examined showed lesions of a hemorrhagic character. The most common was an infiltration of the cortical portion of lymphatic glands with blood; sometimes the entire gland appeared hemorrhagic on section. As regards the relative frequency of this condition, the bronchial, posterior mediastinal (aortic), and inguinal glands stand first; next the retro-peritoneal, meso-colic glands, and those in the lesser curvature of the stomach. The mesenteric glands were rarely affected. Accompanying this condition of the lymphatics is usually a very large spleen, its great size being simply due to an engorgement with blood.

Next in frequency were the hemorrhagic lesions of serous membranes in the form of punctiform extravasations, larger ecchymoses, and very rarely of collections of blood infiltrating the muscular layers beneath the serous membrane. These extravasations are most frequent on the auricles and ventricles of the heart, under the serosa of the large and small intestines, beneath the pulmonary pleura, and in the subcutaneous tissue. In the severest cases blotches appeared on the diaphragm and costal pleura. In about 10 per cent. the kidneys were hemorrhagic. Usually the glomeruli appear as minute blood-red points. To this may be added hemorrhages in the pyramids and extravasations collecting around the papillæ.

The mucous membrane of the stomach in hemorrhagic cases is, as a rule, deeply reddened in the fundus, or else there is hemorrhage into the membrane, more rarely on the surface. The mucosa of the small intestine is usually intact, but that of the large intestine in the acute form of the disease is in the same condition as the stomach. In older cases, when not covered with ulcers, it is either pigmented or dark red, chronically congested. This outbreak was characterized by hemorrhagic lesions more than any other which we have examined. Our experience has been that the early cases are hemorrhagic and are succeeded by those in which ulceration, cellular infiltration of the lymphatics, and marantic conditions, such as serous effusions,

predominate. In some of the animals in this outbreak there were most extensive hemorrhages. In one the mucous membrane of the stomach was separated from the muscular coat by an extensive clot one-half inch thick. In five cases (10 per cent.) the lungs were the seat of extensive hemorrhages, which literally converted the most dependent lobes into a blood clot and filled the pleural sacs with blood-stained serum. In a variable number both peritoneal and thoracic cavities contained much blood-stained serum.

Ulcerative lesions.—Ulcers of the large intestine were present in 36 out of 49 cases, or 70 per cent. They varied from very slight to very severe and extensive lesions, involving in a small number nearly the whole mucous membrane of the cæcum and colon. The rectum was quite invariably free from disease. The age of the ulcers can not be determined, as the process of necrosis and subsequent ulceration seems to vary very much in rapidity. In a few cases it was not limited to the mucous membrane, but extended into the muscular wall, producing considerable local inflammation and thickening of the serous membrane. In rare cases the necrosis and cellular infiltration had made the intestinal wall so friable that it broke when handled. When the ulceration was slight, it was frequently confined to the ileo-cæcal valve and adjacent membrane, where the mucosa is pitted with small mucous glands. The ulceration in this situation was accompanied by an extensive neoplastic thickening of the valve beneath the ulcer, indicating that the ulcer was old. In 5 cases (10 per cent.) the lower ileum was ulcerated; the ulcers seemed to have no relation to Peyer's patches.

Very puzzling to the pathologist is the frequent combination of old ulceration with recent hemorrhagic lesions (about 20 per cent.). Is it due to an increase in the virulence of the bacteria in the recesses of the ulcer, so that when carried into the circulation they are able to live in the capillaries, there to multiply until the colonies cause necrosis of the vascular wall, or is it due simply to the introduction of bacteria into the circulation from the ulcerated region without any increase in virulence? These questions are of great practical importance in the final solution of the problem how severe epidemics may suddenly arise, and seemingly from mild, chronic cases.

Complications.—Peritonitis, pleuritis, and pericarditis were not uncommon complications, usually accompanying old ulceration. These may be caused by septic bacteria gaining entrance through the ulcerations. In fact, cocci, closely resembling those of suppuration, are usually found in the peritoneal cavity of chronic cases.

Lung lesions.—This epizootic was studied mainly for the purpose of determining the condition of the lungs in hog cholera. The lesions found on *post mortem* examination were either simple collapse or lobular broncho-pneumonia following it.

Simple collapse usually involved the two ventral dependent lobes,* more rarely portions of the small cephalic and the principal lobes. The collapsed lobes, or groups of lobules interspersed among emphysematous lobules, appeared slightly if at all depressed. The color approached that of muscular tissue. In only a few instances could plugs be found occluding the bronchus.

Sections made from lobules in this condition show a number of interesting features. The alveolar walls are crowded together in some places till they almost touch one another.

* See p. 65 for nomenclature of lobes of pig's lung.

Besides the fibrin in the alveoli there may or may not be one or several large cells, round, with much protoplasm inclosing a vesicular nucleus. The bronchi are all patent, the epithelium intact. The alveolar walls are not changed, nor is there any round-cell infiltration to be seen. In circumscribed areas the capillary net-work is distended with blood corpuscles, while all the larger vessels are similarly filled with these elements.

In the alveolar ducts there is now and then considerable fibrillar fibrin well brought out by Weigert's stain.

In about 15 per cent. of the animals examined one of the smaller ventral lobes was airless throughout, moderately enlarged. Viewed from the surface the diseased lobe is bright red, dotted with minute pale grayish or yellowish points of a diffuse hazy outline, each not more than 1 micromillimeter in diameter. They are usually arranged in groups of four and represent the ultimate air cells filled with cellular exudate. The larger bronchi are also occluded. The exudate is yellowish white, so firm that it is possible to tear away the lung tissue with needles without necessarily breaking up the inclosed exudate. It may thus be teased out in the form of branching cylinders, becoming smaller and finally dwindling down to the size of a coarse hair. Microscopic sections reveal the alveolar walls beset with distended capillaries. The alveoli are filled up with cellular masses, fibrin appearing very rarely. In most alveoli the cells are large, round, with vesicular nucleus, evidently derived from the alveolar epithelium. In some alveoli and in the smallest air tubes the cell mass is so dense that individual elements can only be seen with difficulty. But they appear to be identical with the cells just described. The process seems to be accompanied with but little inflammation. The desquamation and proliferation go on in the alveoli and smallest air tubes until they are occluded by the casts described.

Of the 49 animals of the same herd, 17 were found with collapse and 8 with lobular broncho-pneumonia; more than one-half, therefore, had some defect of the lungs.

It might be questioned whether such lesions as those of broncho-pneumonia are not due to swine plague bacteria since they closely resemble the appearance found in many swine plague lungs. This question is effectually disposed of by the inoculation of lung tissue into rabbits. From 16 lungs, 16 rabbits were inoculated. Of these, 8 lungs were involved in simple collapse, 8 in broncho-pneumonia. Of these 16 rabbits 4 survived; the remainder died of hog cholera. Of the 4 survivors 3 had been inoculated from collapsed lung tissue; 1 from a broncho-pneumonia. It is interesting to note that of these rabbits, 1 died in six days, 4 in seven days, 3 in eight days, 2 in ten days, 1 in thirteen, and 1 in fifteen days after inoculation. Plate cultures from the corresponding bit of lung tissue showed a variable number of colonies almost invariably non-liquefying, and in many cases identified as hog cholera bacteria.

To determine, if possible, whether lung disease can be produced by innoculation, the following instructive experiment was made:

Two pigs (460, 461), about ten weeks old, received into the right lung, December 21, 3 cubic centimeters each of a beef infusion peptone culture, two days old, inoculated from a single colony growing in a roll culture. This had been made from a bit of spleen tissue from pig No. 46 of the outbreak described in these pages. There were about fifty colonies in the tube, all alike. To test the culture a rabbit re-

ceived at the same time one-ninth cubic centimeter subcutaneously in the thigh. It died in five days. The spleen was much enlarged, blackish, friable, and contained hog cholera bacteria. A roll culture contained numerous colonies after two days.

No. 460 became very weak in its hind limbs in less than a week; respiration short and quick; bowels relaxed. It was found dead on the ninth day.

Superficial inguinal glands normal. Petecchiæ in the slight deposit of fatty tissue beneath peritoneum of abdominal muscles. Spleen about 12 inches long, $1\frac{1}{2}$ wide, and three-fourths inch thick at the hilus; blackish, friable. A few petecchiæ on cortex of left kidney, one cyst the size of a large pea in medullary portion. Large number of small hemorrhages in connective tissue around pelvis of right kidney. Two small urinary cysts not showing on surface. Glands in lesser omentum enlarged, hemorrhagic throughout. In cæcum and colon an almost continuous yellow sheet of superficial necrosis about 1 millimeter thick covering the mucosa. In lower colon it breaks up into isolated patches simulating ulcers. In microscopic sections this layer is found to consist of necrosed epithelium with some round cells. On Peyer's patches, in lower ileum, a yellow, soft exudate rests, which is not adherent and might be mistaken for chyle. Lobes of right lung glued together and to pericardium. Pleura thickened generally, serum very slight in amount, blood-stained. On lobes of left lung, which are also glued together, and on right lung there is a very slight deposit about one-half millimeter thick in the form of a net-work. As a rule the pleuritis and exudate are most marked on the most dependent portions of the lungs. Cavity of pericardium normal. Lung tissue not hepatized anywhere; trachea and bronchi contain a small quantity of reddish fluid. Bronchial glands and those along posterior aorta hemorrhagic throughout. Cultures from pleural cavities, as well as those from spleen, contain only hog cholera bacteria. As shown in roll cultures they were very numerous in the latter organ.

While No. 460 presented such a well-marked case, No. 461, although presenting at first the same symptoms, slowly recovered. The difference may have been due to the fact that with No. 460 a 6-inch needle was used, while with 461 one only 3 inches long. In the latter case the chance for the passage of bacteria into the lung tissue and thence into the intestines was much poorer.

Bacteriological observations.—The preceding experiments on rabbits and the intra-thoracic inoculation in case of the pig are sufficient of themselves to establish the fact that the bacteria described in the two preceding reports, and again found in this epizootic, are the cause of hog cholera. It may be added, however, that out of the fifty-six cases (here reported) hog cholera bacteria were found in the spleen of all but six cases. Even in these the cultures made were too few to make the negative evidence of any value.

In many cases the hog cholera bacteria were associated with a rather large bacillus which, for the sake of convenience, may be called butyric bacillus. This organism was only detected when a bit of spleen was dropped into beef infusion with or without peptone. The cultures kept at about 35° C. contained on the second or third day a cloudy mass limited to the bottom of the tube. The cloud was made up of bacilli, rather large, with a spore in one extremity of the rod, strongly refracting the light. The rod was not enlarged at this end in the fresh state. When dried and stained, the shrunken protoplasm gave the spore-bearing end a swollen appearance, reminding one of the tailed bacteria of older writers. In the few tubes in which this bacillus alone was present the liquid itself remained perfectly clear; when hog cholera bacteria were present it became uniformly but faintly clouded. In liquid cultures without the bit of spleen the bacilli did not develop. This was evidently necessary as food material. In gelatine tubes and roll cultures the bacilli did not grow. Any pathogenic activity can not be ascribed to them. They are anaërobic organisms, probably abundant in the alimentary tract, which were absorbed from ulcers or hemorrhages

into the circulation before death as spores, and their development kept in check until that took place. It is also probable that they are important factors in the rapid changes which may take place after death.

In some half a dozen cases decomposition was so far advanced that no thorough examination was made. At first it was thought that the animals had been dead several days, but the person in charge of the herd asserted that they had died during the night. Although the temperature had fallen below 30° F., decomposition was far advanced. It may be that the live animals crowded upon the dead and thus kept the body warm. Yet this supposition is not capable of accounting for the rapid changes. The hemorrhagic lesions may have enabled various bacteria to become distributed throughout the body. The heat disengaged by them during multiplication, aided by the warmth of the litter, may have been sufficient to keep up the process of decomposition. This *post mortem* growth may also account for the large number of hog cholera bacteria found in many spleens, although the temperature of the air was, as a rule, far below the point where multiplication may take place.

Buzzards may carry the disease from one place to another. When the dead animals were at all exposed to view they were immediately attacked. Whether hog cholera bacteria are entirely destroyed in the digestive tract of these birds can not be said, but there is nothing in the range of our knowledge of bacteria which will exclude the probability that the bacteria are not all destroyed during the digestive act, and that they may be scattered about by these birds. Such observations should strongly urge all persons who have charge of dead animals to bury or burn them immediately, or to have them destroyed in some other effectual manner.

SOME EXPERIMENTS ON THE LENGTH OF TIME DURING WHICH HOG CHOLERA VIRUS REMAINS ALIVE IN THE SOIL.

The virus of hog cholera is quite tenacious of life, in spite of the fact that no spores are formed. In the report for 1886 it was shown that hog cholera bacteria remained alive in ordinary sterilized drinking water for about four months. They resisted drying under certain conditions for nearly two months. During the past year some preliminary experiments were made concerning the vitality of hog cholera bacteria in the soil. This becomes infected during epizootics of this disease by the discharges of the sick perhaps more thoroughly than anything else in the surroundings of the animals. Moreover, it is the most difficult to disinfect, as we have no knowledge of the depths to which the living virus may be carried by water. If it can be shown that the life of such virus in the soil is speedily destroyed, the precautions to be taken would be quite different from those needed if the virus exists for a long period of time.

The experiments undertaken to solve this question are not completed, but the results thus far obtained are sufficiently definite to warrant publication.

A small flower-pot containing soil was sterilized by moist heat and protected from drying and dust by a large bell jar. On its surface about 100 cubic centimeters of a bouillon peptone culture of hog cholera bacteria was poured and the whole maintained moist and at the laboratory temperature. The soil used was a very fine loam from the grounds of the Department of Agriculture.

Roll cultures from the soil after a few days showed immense numbers of bacteria. From this soil rabbits were inoculated from time to time by stirring up a little soil in some sterile beef infusion and injecting the clear supernatant liquid hypodermically. The soil was infected September 17, 1887. The appended table gives the inoculations into rabbits to test the virulence of the soil. The rabbits which succumbed died of hog cholera, as indicated by the lesions and the bacteriological examination:

Rabbit inoculated.	After infection of soil.	Died.
October 10.....	23 days	October 17.
October 18.....	31 days	October 24.
November 4.....	46 days	November 12.
December 12.....	2 months, 2 days.....	December 23.
January 9.....	.....	Remains well.
January 23.....	.....	Do.

The above table shows that infected soil kept moist and at a range of temperature from 60° to 95° F. retained its virulence for rabbits from two to three months. Roll cultures made at this time showed that other bacteria and fungi had found their way into the pot of soil, but no hog cholera bacteria could be detected. This and other reasons drawn from observations of this germ lead to the conclusion that the life becomes extinguished with its pathogenic effect on rabbits. This phase of the question is not to be overlooked, for even if a germ should not longer prove pathogenic, it may regain its original virulence under certain unknown circumstances. The infectious quality of this soil when a month old was demonstrated on pigs by feeding two directly with a tablespoonful each. One showed no disease; the other, unable to rise on the eighteenth day, was killed. The mucosa of the lower ileum and of the entire large intestine was completely necrosed. The intestinal walls were so thick that they failed to collapse when slit open, and were very brittle. Bacteriological examination and rabbit inoculation confirmed the diagnosis of hog cholera.

A pot of sterilized soil which had been saturated throughout with hog cholera germs was placed, December 16, 1887, in the grounds of the Department of Agriculture to test its vitality when exposed to natural conditions. January 5 a rabbit was inoculated from the soil on the surface of the pot. It died January 16 of hog cholera. During the period from December 16 to January 5 the germs had been subjected to alternate freezing and thawing several times without being destroyed. On February 1, one and a half months after infection, the virulence of the same soil was tested on a second rabbit. A severe cold had prevailed since the first inoculation and a thaw was now upon us. The rabbit died of hog cholera on the eighteenth day, indicating that the number of bacteria inoculated must have been very small, and that most of them had already perished: On February 23 another rabbit was inoculated from the surface soil of the same pot. This also died of hog cholera on the eleventh day. Subsequent inoculations remained without effect. Both experiments show that the bacteria perished *between the second and third month*. These and additional experiments now in progress will be reported more in detail hereafter.

ORDINARY LIME AS A DISINFECTANT IN HOG CHOLERA AND SWINE PLAGUE.

Experiments made by Liborius* in Germany have demonstrated that the bacteria of typhoid fever and cholera in man are quite readily destroyed with ordinary slaked or unslaked (powdered) lime. Experiments made during the summer of 1887 and subsequently, in the Bureau laboratory, with lime upon the virus of hog cholera, have been very satisfactory. In fact, the results were sufficiently positive to warrant its use in place of the corrosive sublimate recommended in the preceding report.

Lime has many advantages over the usual disinfectants. It is cheap, is easily obtained and prepared, and may be used with impunity, as it has no poisonous properties. Nor is the soil injured by the addition of a small percentage of lime. The method which was followed out in testing its germicide properties was mainly that used by Liborius.

Bacteria of hog cholera free from any organic or inorganic matter are destroyed within one hour by .03 per cent. of lime; in other words, by lime water diluted to one-fourth its original strength (.12 per cent.).

When the same bacteria are suspended in bouillon as much as .08 per cent. is necessary to destroy them. When a considerable quantity of coagulated albumen, as much as is contained in boiled, unfiltered beef infusion, was present, and in addition a quantity of egg albumen equivalent to two eggs in a liter, the liquid requires between .3 and .4 per cent. of lime before the bacteria are completely destroyed.

These experiments have reference to the disinfection of the discharges of diseased pigs, in which the amount of organic matter can hardly be so great as in the albuminous liquid above mentioned. It will be seen that as this increases in amount a larger per cent. of lime is required. The lime produces a flocculent precipitate which subsides, leaving a perfectly limpid supernatant liquid. The precipitated portion of lime very probably becomes inert.

Experiments were made with soil in the same way. A rich loam, to which large numbers of hog cholera bacteria suspended in simple bouillon were added, was completely freed from living bacteria within one day by adding one-half per cent. of lime by weight to the soil and mixing the two together. The soil had been previously sterilized before the hog cholera bacteria were added. The lime was used in the form of a 5 and 10 per cent. milk of lime.

In the practical application of lime we may say in general that it should be used in place of mercuric chloride (corrosive sublimate) wherever possible. On wood-work it will be efficient as a whitewash. In infected pens the soil should be covered either by powdered lime or slaked lime in a thin layer. The lime-water will percolate into the deeper layers of the soil and destroy any bacteria which have penetrated into them from the surface.

The experiments on the vitality of hog cholera virus in the soil are not sufficiently comprehensive as yet to be made a basis for practical deductions. But, taking all the evidence, it is safe to say that a period of nine months is the maximum and three the minimum time that need be allowed for infected pens and grounds to become safe for occupancy when no disinfection is practiced. Lime as a whitewash on wood-

* *Zeitschrift für Hygiene*, II (1887), p. 15.

work, and scattered over the soil as slaked lime or as powder, used, in short, wherever there is any suspicion of the presence of virus, may reduce the time during which the ground should be kept unoccupied to two weeks. It is our intention to make experiments on the disinfectant power of lime on pens and grounds, so that more definite knowledge of its efficiency on a large scale may be obtained.

It must be borne in mind that none of these precautions can take the place of the isolation of the healthy upon fresh disinfected or uninfected ground. No matter what may be the care taken in disinfection; if one sick animal, manufacturing and carrying virus about within itself, so to speak, be allowed among healthy animals, the disease will spread nevertheless.

The experience which has been gathered at the Experimental Station during the past three years in the study of this disease has shown, (1). That healthy pigs can be kept free from infection, even on a farm where such disease is constantly kept up for purposes of investigations, provided they are kept in clean pens and there is no transmission of virus from the sick to the well through implements of various kinds, through the carelessness of farm hands carrying it on their clothes, hands, shoes, etc.; (2). That the disease may be carried to a previously uninfected locality by pigs bought from unknown sources; (3). That the disease, supposed to be extinct, may lurk in a chronic form in some animal without being recognized, and that this animal may become the source of an acute outbreak among fresh animals, usually in spring and fall when least expected; (4). That the safest method of raising swine is to breed them on the place, either known to be free from disease or thoroughly disinfected, and kept unoccupied for half a year after an outbreak, and not to allow any communication with neighboring herds, nor to make any additions unless the source be positively known to have been free from disease for at least one year past. These rules will apply to swine plague so far as our knowledge of the disease goes, with exceptions mentioned in the article on that disease.

INVESTIGATIONS ON THE ETIOLOGY OF INFECTIOUS PNEUMONIA IN SWINE (SWINE PLAGUE).

In the report for 1886 some preliminary investigations were recorded concerning a disease in swine which differs from hog cholera, not only in the character of the lesions which it presents, but also as regards the organs attacked. The bacteria causing this disease are quite different from those of hog cholera and readily distinguishable by a number of tests. At the time of publication the material which had been examined was not sufficient to warrant a detailed description, nor were proofs adequate for complete demonstration. In February, 1887, an epizootic of this disease, which appeared in the District of Columbia, was carefully studied, and a number of additional important observations made in connection with the peculiar lesions which it produces.

The outbreak referred to appeared on a farm adjoining the Experimental Station of the Bureau in February, 1887. The farm had been free from swine diseases for several years. No clew could be obtained of the manner in which the disease originated. In the later stages of the outbreak the investigation was complicated by the

appearance of hog cholera in the same herd. But sufficient evidence had already been procured to show in a striking manner the non-identity of the two diseases. In this outbreak we were for the first time enabled to convince ourselves of the important fact that in the severer forms croupous and diphtheritic lesions of the large intestine are usually present. These may lead to superficial necrosis of the mucous membrane and the formation of ulcers if the animals live long enough. This fact makes the diagnosis between hog cholera and swine plague far more difficult, unless bacteriological methods are employed. It at the same time accounts for many discrepancies in the results of former investigators in this field, who regarded all infectious swine diseases due to one cause. In the following pages the autopsy and bacteriological notes are given with a few brief comments. Some of the earlier cases were not examined from a bacteriological stand-point, as the disease was at first regarded as hog cholera by the one in charge of the animals. The notes of the hasty examination are given, however, being valuable as far as they go:

Pig No. 406, male, three months old, died February 1. Skin of the ventral aspect of body and inner surface of limbs reddened. Superficial inguinal glands greatly enlarged and diffusely reddened. Spleen very slightly tumefied; on section dark-colored and rather friable; on cortex small, elevated, blood-red points. Interlobular tissue of liver increased in quantity; gives a harsh, gritty sensation to the hand when cut. Medulla of kidneys deeply congested. Lungs normal. Both ventricles of heart contain small quantities of dark, imperfectly coagulated blood. Considerable serum in pericardial cavity. Lymphatic glands of meso-colon and meso-cæcum greatly tumefied and very dark red throughout. Those of mesentery but slightly affected. Quite extensive, firm adhesions between cæcum and adjacent coils of colon. Large intestine filled with a semi-liquid mass containing much sand. Patch of mucous crypts at base of ileo-cæcal valve converted into an ulcer nearly 2 inches across. The intestinal wall forming the base of this ulcer nearly three-fourths inch thick. The superficial necrotic portion, about one-fourth inch thick, is separated from the deeper neoplastic portion of the wall by an irregular hemorrhagic line. This latter portion is streaked with blood. The serous membrane of this patch is covered with radiating vessels of inflammatory origin, and adherent to colon. Three other ulcers in cæcum about three-fourths inch in diameter; in structure like the above. The mucous membrane of cæcum and colon very deeply congested, approaching hemorrhage. Lower portion of ileum contains a few petecchiæ. Stomach normal and filled with food.

This was without doubt a case of genuine hog cholera. The deep ulcerations in the cæcum, taken together with healthy lungs, are sufficient evidence. No cultures were made from the spleen of this animal, although this would have been very desirable in the light of future events. The case is given to indicate the origin of the hog cholera, which appeared later in the same herd, together with the lung disease. The following attempt to infect another animal did not give any definite result:

In order to determine more precisely the nature of the disease affecting 406, No. 358, from another lot, was fed with portions of the spleen and large intestine of this animal. Unfortunately the animal was placed in a pen which had been long infected with hog cholera, but in which the animals had lately failed to take the disease. The feeding took place February 1. It grew very feeble a week after; its appetite began to fail; it finally remained lying down all day, and was found dead February 20.

Autopsy notes.—February 21. Superficial inguinal glands enlarged, bluish-red; parenchyma dotted with bright red points. Some straw-colored serum and a few strings of fibrin in abdominal cavity. Liver dark, filled with blood; right lung hypostatic; right heart filled with dark, partially-coagulated blood. Large intestine distended with consistent fecal masses. Mucosa considerably reddened; minute vessels injected. Two old, healing ulcers, three-eighths inch across, in cæcum; stomach normal; spleen cultures remain sterile.

In the same pen with No. 406 were Nos. 403, 404, and 405. No. 403 died February 16. *Autopsy.*—Pig three months old. Skin over throat, inner aspect of limbs, and pubic region, reddened; entire ventral aspect of body slightly so. Subcutaneous fatty tissue tinged red. Superficial inguinals enlarged and deeply reddened through-

out their substance. Spleen enlarged and very dark, but firm. The small ventral lobes resting laterally upon the heart, which are most dependent in the natural position of the animal, airless and adherent to costal pleura, which is deeply inflamed where adherent. The smaller air tubes of the hepatized masses are filled with a yellowish purulent exudate. Bronchial glands enlarged and congested. All the lymphatic glands of abdomen tumefied and deeply congested. Large intestine empty. Mucosa deeply inflamed from cæcum to anus, being most severe lowest down. In colon and rectum it is covered with a continuous layer of exudate stained a dirty yellow and probably diphtheritic. Slight superficial necrosis of the membrane. Numerous ascarides in stomach, which is nearly empty.

This was without doubt a case of genuine swine plague. The exudative deposit on the mucosa of the large intestine has never been observed by us in uncomplicated hog cholera. Unfortunately no bacteriological examination was made.

A very interesting case was presented by No. 402, which had been in the pen in which No. 406 died. On February 17 a very liquid diarrhea set in, which weakened the animal very much. It was found dead February 19. Large patches of the skin of throat, abdomen, and pubic region deeply reddened. Superficial inguinals very large, cortex hemorrhagic. Sheath of penis infiltrated with blood. Patches of diffuse blood extravasation in subcutis, in abdominal and lower intercostal muscles. Lungs oedematous, a few slender fibers attaching right lung to chest wall. Cephalic lobes emphysematous; small region of ventral lobes hepatized, grayish red. Extravasation of blood beneath pleura on dorsal aspect of lungs, near root. Cortex of bronchial and œsophageal glands infiltrated with blood; bronchi filled with whitish foam. Epicardium dotted with punctiform extravasations on auricles, and near base on ventricles. Small clot in right heart, left empty. Liver bloodless. Kidneys pale, hemorrhage into membrane inclosing papillæ. A few petechiæ on cortex. Serosa of small intestines covered with oblong purplish patches, found to correspond with Peyer's patches, which are very dark throughout. In many there is hemorrhage on the surface. Beneath serosa of large intestine numerous petechiæ and hemorrhages. All glands of abdomen with cortex hemorrhagic. Mucosa of colon very dark, and covered with isolated yellowish-white masses from one-eighth to one-fourth inch in diameter. These are fairly consistent, and come away entire, leaving a slightly depressed surface. In the rectum this exudate has coalesced into a continuous sheet. Fundus of stomach covered with a layer of clotted blood; when removed the exposed mucosa is found dotted with closely-set hemorrhagic points, evidently the source of the hemorrhage.

This case is of considerable interest. In the first place the extensive hemorrhages throughout the body have left the organs almost bloodless. The lungs were without doubt beginning to consolidate, and the very important question arose: Are the swine plague bacteria at times the cause of such severe hemorrhagic lesions as are presented there?

Examination on cover-glasses of the parenchyma of the various organs proved negative as regards micro-organisms. A large number of cultures were made with the following results: Two tubes of beef infusion inoculated with shreds of pleural exudate remained sterile. Two tubes of beef infusion peptone received each a bit of spleen tissue. In both large bacilli developed, either single or in long chains, some spore-bearing, the spore causing a considerable local increase in the width of the rods, giving them a spindle-shaped or club-shaped outline, according as the spores were situated nearer the center or one extremity of the rods. A few were observed to execute spontaneous movements.

Two tubes of beef infusion, inoculated each with a bit of liver, contained the same bacilli; also a microbe resembling the swine plague bacteria very closely, and a streptococcus. A liquid culture of blood from the heart contained the bacillus only. A gelatine tube culture made by dropping into it a few drops of heart's blood developed numerous translucent waxy colonies, made up of several kinds of bacteria. The gelatine after a few days began to liquefy. Two tube cultures in gelatine, containing each a bit of spleen, began to liquefy after a few days with disengagement of bubbles of gas and a peculiar, unpleasant odor. The same large bacilli present in both tubes.

These results indicate absence of a perceptible growth of bacteria in the internal organs. Owing to the extensive hemorrhages upon the mucous surfaces, the various microbes found in the cultures gained access to the blood. The bacillus found in almost every culture is presumably some form causing butyric fermentation. This is shown by its spore formation, feeble growth in cultures exposed to the air, and the odor of the cultures. The animal probably died early in the night, and the warm weather then prevailing gave the bacilli ample opportunity to multiply. Their general distribution seems to favor the assumption that the bacilli or their

spores were distributed by the blood current before it ceased. The lesions were not due to the bacterium of hog cholera, although resembling this disease, if we except the hemorrhagic condition of Peyer's patches in the ileum, which we had not seen in the severest cases of hog cholera.* Had the disease been hog cholera the bacterium would have been revealed in several or all of the cultures made.

Were these lesions due to swine plague bacteria?

To determine whether the microbes seen in the impure liquid culture from the liver were swine plague bacteria a rabbit was inoculated by means of a hypodermic syringe beneath the skin of the thigh with about one-eighth cubic centimeter of this culture. It was found dead within forty-eight hours.

Locally there were blood extravasations into the connective tissue and muscles of the thigh and contiguous abdominal wall. There was also a gelatinous infiltration of the fasciæ of the muscles. Lungs oedematous; spleen dark; parenchyma of liver very friable. Stomach distended with food. Mucosa covered with a layer of tenacious mucus. Immense numbers of bacteria in spleen, liver, and blood from the heart, all showing the characteristic polar stain of the swine plague bacteria. Very few in kidneys. From the blood and spleen pure cultures in tubes of gelatine were obtained.

An impure gelatine culture from the blood of this pig inoculated into a rabbit gave precisely the same result. The rabbit died in three days of a septicæmia due to the swine plague bacteria, which were found in abundance in the spleen, liver, and blood. Cultures were equally confirmatory. Hence both blood and liver of the pig contained these bacteria. The appended table gives the results of the inoculations:

Pig No. 402, February 19.	
b. i. p.† culture, liver	gel.‡ cult. blood
rabbit, February 24 died February 26 (cults. blood, and spleen contain only swine plague bacteria).	rabbit, March 2 died March 5 (cults. liver, blood, contain only swine plague bacteria).

A pig (No. 377), after being deprived of food for nearly a day, was fed February 20 with portions of the spleen, large and small intestine of No. 402. The handling of the animal resulted in slight lameness for a few days. Its appetite became poor. In a month after feeding (March 23) it was in a dying condition, and was consequently killed for examination.

The *post mortem* examination gave no clew as to the nature of the disease. There were no indications of hog cholera. There were no specific lesions referable to swine plague. Previous as well as subsequent experiments have convinced us that the specific lung lesions of swine plague can not be produced by feeding. The lesions found are briefly as follows:

Superficial inguinal glands very large, infiltrated with a pale serum; cortex of some of the lobules contain extravasated blood, medullary portion whitish, lardaceous. Peritonitis indicated by very slender threads of fibrin stretched across the coils of intestine. Lungs and digestive tract normal. Right ventricle distended with a clot, the center of which is pale. Two liquid cultures from peritoneal fluid remained sterile.

No. 405 was found dead February 18, after several days of great weakness and diarrhea. The severest lesions were confined to the lungs and the large intestines, as the following *post mortem* notes indicate:

Patches of skin on the inner aspect of limbs, over the abdomen and pubic region, deeply reddened. Lymphatics of meso-colon enlarged, but pale. The mucous membrane of the large intestine presents throughout a dark red, raw aspect, and is covered more or less entirely with a continuous layer of exudate, which readily comes away. Ventricles of heart filled with very dark, partially coagulated blood. The ventral portion of both lungs, involving perhaps one-half their entire volume, hepatized and portions of it firmly adherent to the thoracic wall, the diaphragm, and pericardium.

The disease seemed to involve all below a horizontal line when the lungs were

* Excepting in those fed with liquid cultures. See Annual Report Department of Agriculture for 1886, p. 614.

† Beef infusion containing 1 per cent. peptone.

‡ Beef infusion containing 1 per cent. peptone and 10 per cent. gelatine.

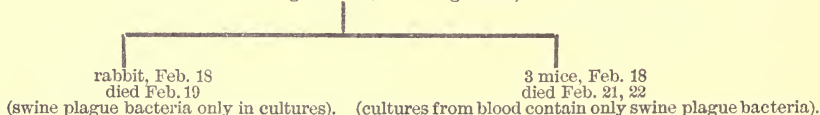
held in the position normally occupied in the body, as if the agencies producing the lesion had settled into the most dependent portions and there began their pathological action first. The portions affected were thus the small ventral lobes resting on the pericardium, these being lowest in the natural position of the animal, and portions of the cephalic and principal lobes. Those portions resting against the vertebræ were still normal.

The color of the hepatized regions was grayish red to reddish yellow, sprinkled with closely set yellowish white spots from one-half millimeter to 5 millimeters in diameter and slightly prominent. On section the same appearance presents throughout the diseased lung tissue. The recently affected lobules are either uniformly and deeply reddened or sprinkled with a large number of very minute whitish points. Odor slightly putrefactive.

The yellowish-white masses were firm and cut with a smooth surface. Microscopic examination showed them to be made up of broken-down cells, among which were immense numbers of various kinds of bacteria. These lesions were evidently produced by the same cause that we had studied in western outbreaks. There was but one way to speedily isolate the specific microbe from the mass of other microbes which were living in the dead cell masses. Three mice were inoculated by placing beneath the skin of the back bits of lung tissue from the recently diseased areas. A rabbit was inoculated in the thigh in the same way by making an incision through the skin, which had been disinfected with .1 per cent. mercuric chloride, introducing a bit of lung tissue and drawing together the incision with a stitch.

The rabbit died within 24 hours. Very slight purulent envelope about bit of tissue. No other reaction locally. Nearest lymphatic hemorrhagic. In it, as well as in blood from the heart, spleen, and liver, immense numbers of the polar-stained bacteria. Cultures in gelatine and liquid from blood pure. Two mice died on the third day. Bacteria present in small numbers. The third died on the fourth day. Immense numbers of the same bacteria in blood from heart. Pure cultures from the latter organ were obtained from each mouse.

Pig No. 405 (bit of lung tissue).



One of the most pronounced cases of this disease died February 21, and was examined on the following day.

No. 407. Pig of medium size, white; skin of abdomen, chest, neck, and back deeply reddened. Fat abundant, slightly reddened along the linea alba. Superficial inguinals slightly enlarged; spleen dotted with elevated blood-red points. Liver very dark. Stomach and duodenum normal, the latter bile-stained. In ileum Peyer's patches are visible as groups of small, dark dots; no swelling. Mucosa of cæcum and upper colon of a dirty, blackish color, probably pigmented. A few hæmatomata beneath mucosa. Besides the diffuse pigmentation the mucosa is sprinkled with isolated or confluent masses, about one-eighth to one-fourth inch in diameter, of a dirty grayish-yellow color, loosely adherent to the membrane. When pulled away a slightly depressed surface is exposed. Much of this mass can be easily removed by simply moving the scalpel over it. There are several ulcers in the cæcum with decided loss of substance. The patch of mucous glands at the base of the valve is also converted into an ulcerated mass. Lymphatic glands in abdomen slightly swollen and reddened. Kidneys deeply reddened to tips of papillæ.

On opening the thorax the lungs did not collapse, and a rather disagreeable odor was perceived. As in No. 405, the ventral and cephalic lobes of both lungs were consolidated. The hepatized regions were very hard to the touch, bright red, with yellowish points sprinkled in regularly. (See Plates I, II, III, fig. 1.) The right lung was adherent to chest wall along the hepatized portion. A whitish, spongy membrane was interposed, about 3 millimeters to 5 millimeters thick, inclosing a small quantity of turbid liquid. On removing the lung the membrane remained adherent to pulmonary pleura and was removed with difficulty. A portion of the diaphragm was also firmly attached. The left lung adhered firmly to the chest wall in two places where it was consolidated. The costal pleura was deeply reddened, owing to the injection of a close net-work of minute vessels. Trachea and bronchi filled with whitish foam.

On section, the consolidated region is sharply but irregularly marked off from the normal tissue, very consistent and slightly elevated. The color varies from a

bright red (recent) to a grayish red. In all, the minute grayish points are present from 1 millimeter to 2 millimeters in diameter, about the same distance apart, and of a hazy outline. The smaller bronchi are filled with a purulent fluid. In the surrounding lobules in which the disease is more advanced the interlobular tissue is distended with a serous infiltration; the large vessels are filled with very consistent dark clots. Heart rather large; pericardium free; right auricle, ventricle, and large veins distended with thrombi; smaller white thrombus in left ventricle.

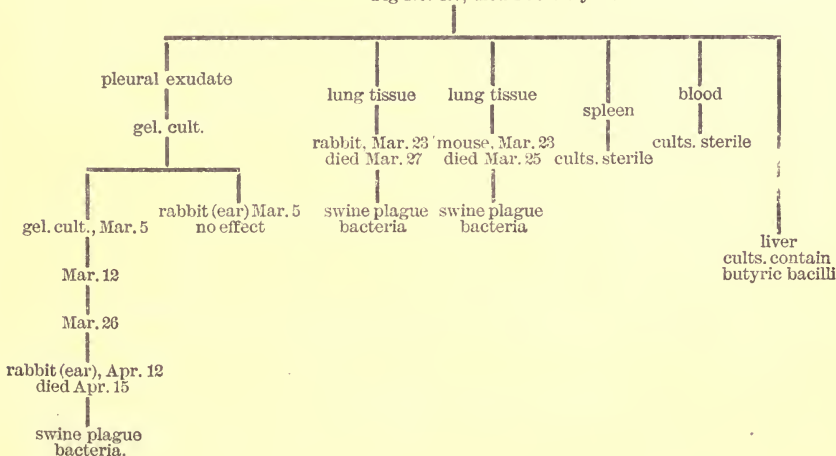
Microscopic examination of the lung tissue in cover-glass preparations shows the presence of numerous bacteria with the polar stain in recent lesions; in older ones they are rare. Other forms are present, but only in small numbers. The pleural exudate was made up of round cells, bound together by bundles of fibrin; it contained few bacteria.

In transverse sections of the large intestine, where a mass of exudate is still attached, the muscular and submucous layers are intact, if we except a slight cellular infiltration near the base of the crypts. The mucous layer, however, is considerably changed. The surface epithelium, including a portion of the crypts of Lieberkühn, is no longer distinguishable, but merges without demarkation into an exudate several millimeters thick, consisting of leucocytes imbedded in a mesh-work of fibrin, the whole refusing to stain. The pathological process seems to be diphtheritic in nature, the membrane being attacked from the digestive tube and not from the submucous tissue.

Pure cultures of swine plague bacteria in tubes of gelatine were obtained from the pleural exudate. In each needle track a large number of colonies developed. A piece of the false membrane gave the same result. Cover-glass preparations from spleen and liver were negative. Two tubes of beef infusion into which bits of spleen had been dropped remained sterile. Two similar cultures from the liver contain each the bacillus butyricus, evidently of *post mortem* growth. The blood from the heart was also free from bacteria, for two tubes of gelatine, each inoculated six or seven times with blood, did not develop a single colony.

These results show that the specific microbe is not regularly present in the internal organs, and can only be obtained from the diseased lungs and pleura. A rabbit inoculated in the ear with a bit of lung tissue died within four days. There was no swelling or reddening of the ear. Lungs deeply congested (hypostatic?). Immense numbers of swine plague bacteria in blood, spleen, and liver. Cultures from blood and liver contained only the same organisms. A mouse inoculated with a bit of lung tissue succumbed within two days. Bacteria very scarce in body. Pure cultures of swine plague bacteria were, however, obtained from heart's blood.

Fig No. 407, died February 21.



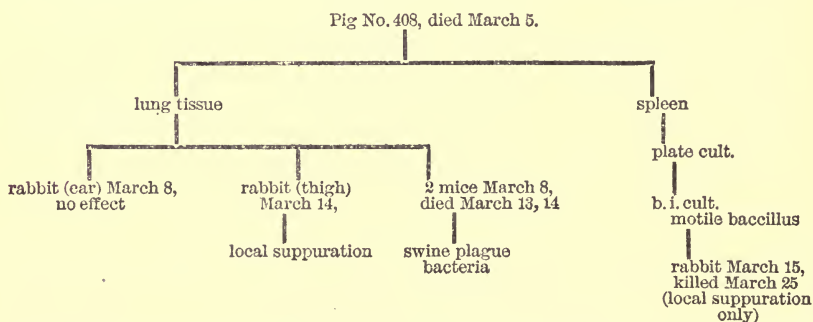
No. 408 from the same farm died March 5. The *post-mortem* examination was delayed forty-eight hours, the temperature being above the freezing point a part of the time.

Skin diffusely reddened over the entire body. On buttocks tough and leathery. The most marked lesions found in the internal organs are briefly as follows: On section of kidneys six or seven petechiæ on each pyramid. In fundus of stomach, which

was filled with food, some small erosions of the mucous membrane. In the large intestine, the mucosa of cæcum dark-red, almost blackish, and covered with large ragged ulcerations only 1 millimeter or 2 millimeters deep. The membrane appeared as if gnawed. The ileo-cæcal valve is almost completely surrounded by ulceration, the base of the ulcers being blackish, and the mucosa much puckered. The colon is bright red, dotted with darker points, and covered with small ulcerations, circular as if punched out. The base of the ulcers is concealed by a creamy mass, the border slightly thickened and intensely reddened. In some places the ulcers number five or six to a square inch. Besides these small ulcers there are several about one-half inch across, resembling the ragged ulceration in the cæcum. The contents of intestine resemble lumps of sand and mud, some extremely hard. Sections through a few of the small circular ulcers show that they have arisen around the mouths of mucous glands.

On opening thorax, lungs collapse. Slight fibrous adhesion of right lung to thoracic wall near diaphragm. In each lung the cephalic, ventral, and a small portion of the principal lobe, as well as the small azygos lobe, solidified. The hepatized portions are bright red, dotted with very minute, closely-set, grayish spots, well shown in fig. 2, Plate III. Examined with a lens these spots have a nebulous appearance. On section this same mottled appearance. A few lobules and groups of lobules are converted into greenish-yellow, consistent, cheesy masses. Trachea and larger bronchi filled with whitish foam. The smaller bronchi clogged with viscid mucus inclosing air bubbles. Cover-glass preparations of alveolar exudate contained cocci, of the spleen no bacteria of any kind. Cultures from the surface of the pleura remained sterile; a liquid culture from the spleen contained three or four forms of bacteria. One of these was evidently the microbe found in former cases. A second form, a motile bacillus, isolated from this culture with the aid of gelatine plates, resembled the bacterium of hog cholera in some features, differing from it in others. Without giving these, suffice it to say that a rabbit inoculated subcutaneously with one-third cubic centimeter liquid culture was killed in ten days. The lesion was purely local; extensive suppuration of the connective tissue of the inoculated thigh. The lymphatic glands of axilla on the same side enlarged, one of them hemorrhagic throughout. The internal organs were normal; no evidence of those lesions always following inoculation with hog cholera bacteria.

March 8 a rabbit was inoculated by pricking both ears with a lancet and inserting into the wound some of the alveolar exudate from the solidified lung tissue. No result. Another rabbit was inoculated with the same lung tissue a week later, which had been meanwhile kept in the refrigerator. A small bit of lung tissue was placed beneath the skin of the thigh and the wound closed with a stitch. It was killed a week later, though apparently well. A large mass of cheesy pus was found at the place of inoculation in the subcutis. Internal organs normal. Two mice were inoculated March 8 by placing bits of lung tissue beneath the skin at the root of the tail. They died March 13 and 14, respectively. In the heart's blood of both the characteristic bacteria found hitherto, and showing the polar stain very clearly, were found in large numbers. Cultures therefrom corroborated the microscopic examination. A table giving the inoculations is appended:



Another pig (No. 409) had been with Nos. 405 and 406 before January 31. Since February 1 this animal began to fail. It became emaciated and weak, diarrhea set in, a cough was heard when the animal was incited to move. It died March 20. Body very thin; skin of ventral aspect covered with elevated brownish scales one-eighth to one-fourth inch in diameter, easily torn away, and involving only the epidermis. Petechiæ had been observed in the same situation during life; superficial

inguinals considerably tumefied, of a mottled, pale-red color. *Digestive tract.*—Stomach distended with food, cardiac expansion softened and apparently macerated. In the large intestine the mucosa was roughened and covered with pigment spots 1 millimeter to 2 millimeters diameter, giving the whole membrane a dark appearance. In the blind end of the cæcum and in several of the saccular dilatations of the colon the mucous membrane is superficially eroded, giving rise to circular, shallow ulcers covered with a whitish deposit. The lungs were extensively hepatized. The solidified portions involved the same regions as those heretofore described—cephalic and ventral lobes and the ventral portions of principal lobes. Only a small area of the principal lobe presents the bright red ground mottled with grayish points. The remainder of the solidified lung tissue is of a uniform greenish, waxy tint, both on surface and section; the bronchi plugged with mucus. In those portions of the principal lobe which appear normal are scattered groups of hepatized lobules. Cover-glass preparations from the diseased regions of older date show chiefly pus corpuscles with irregular fragmentary nucleus staining well in methylene blue. On one cover-glass was found a large colony of minute bacteria resembling those of swine plague.

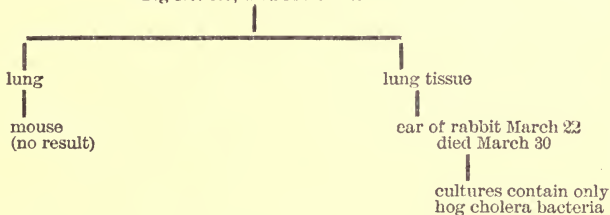
In sections from the hepatized lobes the alveoli were found, as usual, filled with cellular elements. Among these chains of streptococci, consisting of at least 15 to 30 cocci, were found. In some alveoli only a few were present, in others a considerable number of interlacing chains could be seen. This streptococcus, which stains very well, according to Gram, will receive more attention later on. No groups of cocci resembling those of the swine plague bacteria could be found in the few sections examined.

Cultures from spleen and liver were found to contain several kinds of bacteria. A tube culture in gelatine of heart's blood remained permanently free from bacterial growth.

From a cheesy mass in the lungs a large white rabbit was inoculated in both ears. On the following day both were swollen, red, and drooping back. A few days later they were again normal, and although rather quiet and stupid it seemed well. On the eighth day it was found dead.

Slight swelling about lancet puncture on which there is some dried blood. Ear otherwise normal, a few strings of fibrin on intestines, spleen enormously enlarged. Liver dotted with areas of coagulation-necrosis 1 millimeter to 2 millimeters across. Extensive pericarditis, the two layers of the pericardium firmly adherent. Pleuritis on both sides. The lesions were those caused by hog cholera bacteria, and these microbes were found in large number in spleen and liver. Only a few in the pericardial exudate, none in blood. Gelatine cultures of spleen and liver and three beef infusion cultures of blood from the heart contained the motile hog cholera bacteria only.

Fig No. 409, died March 20.



Another animal (No. 410) from the same farm and herd was attacked with a severe skin disease, in which a large area of the skin of the back came away as a slough, exposing the muscular tissue beneath. The animal became reduced and was found dead March 29.

The ventral aspect of the body and limbs covered with round, slightly-raised scabs, about one-fourth inch in diameter, with bluish-red border. The scab, consisting merely of epidermis easily torn away, covers a deep-red surface. The extensive sloughs on the back have already been mentioned. Stomach filled with a turbid liquid, the membrane of fundus reddened and covered with tenacious mucus, which it is almost impossible to scrape away. Mucosa of large intestines of a deep red throughout made up of crowded bright red points. No ulceration. *Lungs* not collapsed; left hypostatic. Both principal lobes oedematous; cephalic half of right lung emphysematous. Hepatization involves, in the right lung, only the extreme tip of cephalic lobe, one-half of ventral lobe, and the ventro-cephalic corner of principal lobe; in the left lung only a few lobules of the ventral lobe. The small

median (azygos) lobe is solidified along the border in several places. Right heart filled with a large thrombus, firmly adherent to papillary muscles. Left heart contains a small dark clot. Large vessels near heart and in lungs distended with white thrombi.

Bacterial investigations negative. One rabbit inoculated with bit of lung tissue in thigh remained well. Two mice inoculated with lung tissue died on the following day. Cultures from blood remained sterile. All but one culture from spleen and liver remained sterile. This contained a bacillus growing in the bottom of the liquid (butyricus?).

In order to test the communicable character of this lung disease, two healthy pigs (Nos. 359, 360) were taken February 28 to the farm and penned with Nos. 408, 409, 410. At this time two of these three were already diseased, and No. 407 had already died in the same yard. On March 16, No. 408, having meanwhile succumbed to the disease, the remaining four were taken back to a clean pen on the Experimental Station. No. 409 died March 20, as already stated, and No. 359 was found dead March 24. It had been so weak as to be scarcely able to stand, although apparently free from cough. No skin lesions; superficial inguinal glands enlarged, pale, medullary portion dotted with blood-red points. A few slender fibrinous strings stretched across the coils of intestine. Stomach contracted, containing about 50 cubic centimeters of a turbid yellow liquid. The walls covered with tenacious bile-stained mucus. Gall bladder contracted; contains an ascaris; one in cystic duct. Mucosa of large intestine dark colored. In cæcum four or five large ulcers, one surrounding base of valve. In another, about one-half inch across, the necrotic center projected like a button. In colon a large number of small ragged patches of a thin deposit which seems to be dead epithelium. *Thorax*.—Lungs do not collapse when thorax is opened. The major portion of both, excepting dorsal region, closely adherent to chest wall. The attachment being severed without difficulty, both pleural surfaces are found covered with a thin grayish deposit. Small quantity of turbid liquid present in pleural cavity; diaphragm entirely but loosely adherent to the pulmonary pleura. Portion of pericardium also adherent to pleura on the right side.

When the lungs were removed from thorax, all but the dorsal region found solidified. Even in this there were scattered hepatized lobules. The lung tissue varies in color from a pale to a bright red and resembles the diseased lungs already described. The smaller bronchi of the affected lobes were, as a rule, occluded with more or less consistent whitish plugs. Bronchial glands enlarged, cortex bright red.

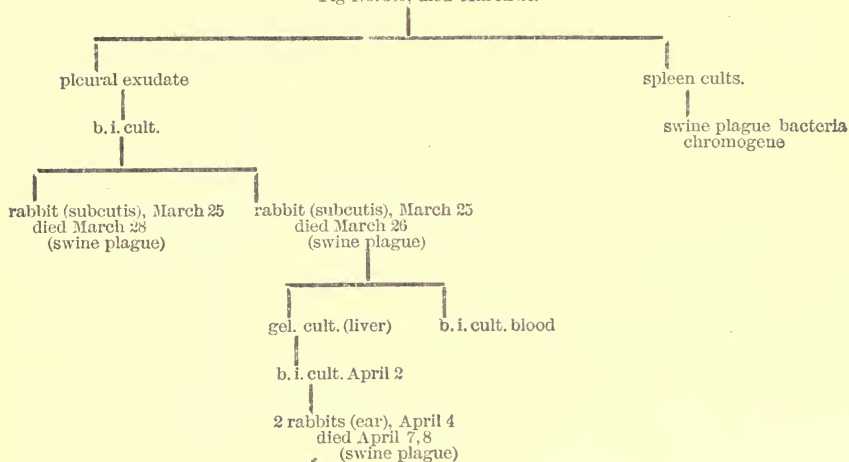
Heart but slightly distended. Right ventricle filled with a firm washed clot; right auricle with a dark, soft clot. Left ventricle contains a small, dark clot; left auricle the same. This latter is dotted with closely-set, bright-red petechiæ, as if sprinkled with blood. Great vessels filled with dark clots.

Microscopic examination reveals a large number of swine plague bacteria in pleural exudate, immense numbers in the lung tissue. The whitish plugs in the small air tubes contain a moderate number mingled with other forms. Sections of the same lung tissue showed immense numbers of swine plague bacteria among the alveolar exudate. Bacilli were also present, but in small number. The following cultures were made: Of two beef infusion cultures from the pleural exudate one contained the swine plague bacteria only, the other in addition a streptococcus. With the pure culture two rabbits were inoculated by injecting one-fifth cubic centimeter beneath the skin of the thigh. One of them (small white) was dead next morning. A few ecchymoses in the subcutis at point of inoculation. The internal organs appeared unchanged. Both spleen and liver contained immense numbers of the injected bacteria—pure cultures of which were obtained from blood of heart and liver. The second rabbit was found dead on the third day. There was locally an extensive infiltration of the subcutis with superficial degeneration of thigh and contiguous abdominal muscles. Slight peritonitis. Hemorrhage into caudal lobe of right lung. Very few bacteria in spleen, liver, and heart's blood. A tube culture in gelatine shows the colonies in a few days.

Subsequent inoculations were made from cultures derived from the first rabbit. Two rabbits were inoculated in the ear with a lancet dipped into the culture liquid. Both died on the third and fourth day after inoculation. The swine plague bacteria were found in the spleen of both.

Of two gelatine cultures from the pleural exudate both are impure, one containing besides the swine plague bacteria also the streptococcus, the other a chromogenous bacillus, described as *bacillus luteus* in the Second Annual Report of the Bureau (1885). Of three cultures from the spleen in beef infusion the *bacillus luteus* is present as well as the swine plague bacteria. This chromogenous organism had penetrated into the internal organs, the streptococcus being limited to the pleural cavity.

Pig No. 359, died March 24.



No. 360 was exposed February 18 with pig No. 359, just described. After one month of exposure it became very weak and emaciated and kept on failing until it was found dead April 6. Its abdomen was very much distended: this distension had appeared before death. Superficial inguinal glands somewhat enlarged and congested. Peritonitis indicated by some reddish serum and by strings of fibrin stretched across coils of large intestine. The latter were greatly distended with gas and semi-liquid feces. Glands of meso-colon hemorrhagic. Lungs collapsed, quite red. Exostoses as large as marbles on four right lower ribs near cartilages. No other lesions observable. This animal, therefore, had not contracted the disease as observed in those animals with which it had been penned.

Another animal (No. 378) which had been growing poor for nearly a month and finally died was also affected with extensive hepatization of the lungs. The lesions observed were briefly as follows:

Scaly patches on the side of neck, on buttocks. About 25 cubic centimeters of yellow serum in abdomen, a few strings of coagulated lymph on coils of intestines. Liver dark, resistant. Gall bladder distended with dark-brownish bile. Stomach empty, bile-stained. Mucosa of intestinal tract dark, probably due to venous stasis; no ulceration. Heart large, flabby. Right heart filled with a very dark soft clot. Left auricle distended by a very firm white thrombus, left ventricle partly filled by a dark clot. All vessels leading to and from heart filled with molds of dark coagulated blood. Lungs partly collapsed. Slight fibrous adhesion of each lung to chest wall. The cephalic and ventral lobes of each lung and the azygos lobe airless, solid, of a grayish-red, semi-translucent, or waxy appearance; bronchi plugged with a glairy mucus. At least one-half of the left principal lobe and one-third of the right hepatized, being the ventral portions. The disease was moving from the ventral to the dorsal side, *i. e.*, from below up when the animal is standing, the only portions not affected being those nearest the back-bone.

Although forms resembling swine plague bacteria were found on microscopic examination in the solidified portions, a rabbit inoculated on the ear did not succumb.

The microscopic examination of sections made from that portion of the lungs most recently affected and stained according to Gram gave some interesting results. Capillaries very much distended, with red corpuscles, so that alveolar walls appear very thick. Alveoli and smallest air tubes plugged with dense masses of cells, epithelioid and round. In the alveoli are found chains of cocci (*-treptococcus*) from five to twenty in a chain, winding in and out through the cell mass. They are approximately 1 micromillimeter long, slightly oval, and stain very deeply. In some groups of alveoli these streptococci are very numerous, in others they are few in number, or else replaced by another form consisting of minute bacilli in groups of few to many, usually within the protoplasm of the cells contained in the alveoli. These bacilli resemble tubercle bacilli very closely. In some alveoli they are exceedingly numerous. These two forms of bacteria, stained dark blue and strongly contrasting with the brown color of the cells (bismarck brown), were perhaps the only ones present, none others in sufficient numbers to be detected.

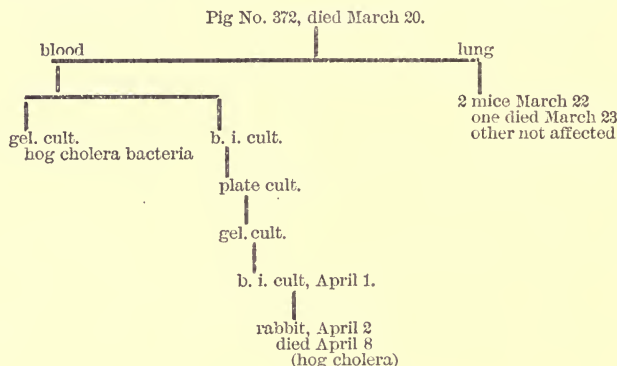
Cultures from blood of heart, spleen, and liver remained sterile.

No. 372 had been exposed in a pen, infected with hog cholera, to the lung disease. It had therefore been exposed to two different diseases. It began to grow weak and stupid, eating very little until death, on March 20, more than a month after the earliest symptoms of disease. This animal was found with extensive lung disease, while its internal organs contained hog cholera bacteria, as the following remarks indicate.

Animal with moderate amount of fat. Stomach bile-stained. Gall bladder filled with a thick prune-juice colored mass. Beginning sclerosis of liver. No intestinal lesions. *Lungs*.—Right ventral and left ventral lobes almost entirely solidified. Median ventral and cephalic border of right principal lobe solid, exceedingly hard to the touch; pleura covering it thickened. On section the lung tissue is found converted into a grayish, homogeneous, caseous mass. In left principal lobe a mass of tissue about 2 square inches in extent is solidified, some lobules being caseous, others still red. In the hepatized ventral lobes there are many lobules converted into a yellowish-white, homogeneous mass, almost cartilaginous. The small bronchi exude a glairy purulent mucus.

In the recent lesions bacteria few in number; in the caseous masses immense numbers, nature not determinable.

Liquid cultures from blood and spleen contain not swine plague but hog cholera bacteria. A gelatine culture from the blood contains the same bacteria. A rabbit inoculated subcutaneously with one-fourth cubic centimeter of a beef infusion culture died on the sixth day with greatly enlarged spleen and coagulation-necrosis of liver. In both organs the injected bacteria were present in large numbers. Of two mice inoculated with lung tissue one died next day; no examination made. Unfortunately no rabbit was inoculated from the lung tissue.



Pig No. 397 illustrates well the existence of two diseases in the same animal, the hog cholera bacteria being obtained from the spleen, the swine plague germs from the lungs. This animal was fed with the hepatized lung of pig No. 378 on March 24, and three days later with lung tissue from pig No. 359. In a week it became feeble, especially in the hind limbs, dull, without desire for food. April 13 diarrhea set in and it died next day. *Post-mortem* examination revealed extensive disease of the lungs and large intestine. The animal had contracted swine plague first; upon this disease hog cholera was grafted, which probably was the immediate cause of death.

Slight discoloration of skin on ventral aspect of body. Superficial inguinal glands enlarged, cortex infiltrated with blood, medulla dotted with petechiæ. Some fibrils of coagulated lymph across coils of intestines; small quantity of serum present in abdomen. Mesenteric glands very large, deep red. On section almost entirely infiltrated with blood, excepting a few patches of the medulla, which are homogeneous yellowish white; glands of meso-colon dark red. Spleen greatly engorged with blood, friable. In liver the connective tissue increased in quantity; parenchyma softened.

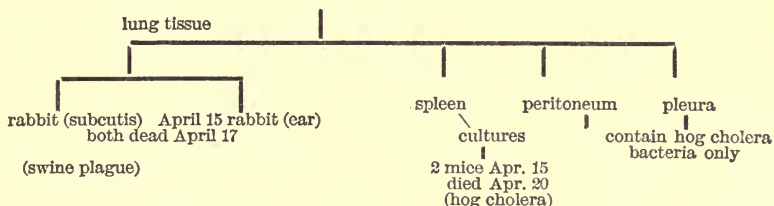
In thorax the right pulmonary pleura covered with a thin film of exudate. Considerable yellowish serum in both pleural sacs. The cephalic and ventral lobes and the ventral portion of principal lobe hepatized. The hepatization presents that peculiar grayish-mottled appearance on a deep-red ground; trachea filled with whitish foam. *Digestive tract*.—Stomach filled with a turbid yellowish liquid, mucosa in general bile-stained, in fundus deeply reddened. In the large intestine the mucosa is uniformly and very densely sprinkled with dark-red points. A dirty,

yellowish, projecting ulcer on base of valve. Four or five of the same character, three-eighths to one-half inch across in cæcum and upper colon. In this animal the brain and spinal cord were laid bare. A few punctiform recent extravasations, chiefly in the white matter of the cerebellum.

With a bit of lung tissue two rabbits were inoculated—one beneath skin of thigh, another in the ear. Both were found dead within forty hours after inoculation; the bacteria of swine plague present in spleen and liver in large numbers, and obtained pure in cultures.

From the spleen, pleural, and peritoneal exudate the hog cholera bacteria were obtained pure. They were very scarce in the pleural exudate, however, as two out of three liquid cultures remained sterile. Two mice inoculated from the spleen culture were dead on the sixth day, both of hog cholera from the injected cultures.

Pig No. 397 died April 14.



No. 396 is another interesting case of lung disease complicated with hog cholera. This animal had been fed February 22 with portions of the spleen and large intestine of No. 407, which has been dwelt upon in the preceding pages.

A few days after feeding it began to show signs of disease by growing weakness, especially marked in the hind limbs, no desire for food, and a slight diarrhea. A month after feeding, constipation set in, while the weakness of the hind limbs was very marked, bordering on paralysis, and anorexia continued. In the seventh week diarrhea again set in: the animal was unable to rise and died April 18, nearly two months after feeding. It was found with severe and extensive lesions of the lungs and large intestine. (See Plate IV.)

Digestive tract.—Stomach filled with food; normal. Large intestine, excepting rectum, ulcerated. Ulcers surrounding valve and forming a confluent mass in cæcum. In upper colon there are masses of exudate from one-eighth to one-fourth inch in diameter, at least 20 to a square inch (Plate IV, fig. 2); lower down fewer in number. They are roundish, convex, brick-red masses which may be easily lifted from a raw, slightly depressed surface; every one is surrounded by an injected border. The mucosa itself is of a bluish-green color.

Lungs.—Right ventral lobe firmly and closely adherent to chest wall by a continuous sheet of fibrous tissue. This lobe feels like a bag filled with hard round bodies. On section it is found filled with whitish homogeneous masses resembling hard cheese (Plate IV, fig. 1) embedded in bright-red, hepatized lung tissue. Left cephalic lobe in the same stage. The remainder of the left lung contains groups of lobules recently hepatized. Cavities of heart as in preceding cases.

Two rabbits and two mice inoculated in the ears with lung tissue without any result.

Gelatine cultures from pleura remained sterile. A culture from the spleen contained several forms, one of which resembled the hog cholera bacillus. After isolating this, two mice were inoculated from a pure culture. Both died in seven days with lesions characteristic of this disease.

The hog cholera germs were therefore present in this animal. The swine plague germ was not isolated, perhaps because the germs were too few. In such cases inoculation on the ears of rabbits seems to fail, since only a minimum quantity of lung tissue comes in contact with the puncture.

Whether the lung disease of this pig was contracted from the feeding must be determined from additional cases.

No. 392 died from swine plague, with a few doubtful hog cholera lesions and with hog cholera bacteria in the spleen. The remainder of the exposed animals had no swine plague lesions, but death was caused by acute hog cholera.*

The history of this animal is instructive, as it was inoculated from a culture of swine plague bacteria, which operation did not protect it from taking the disease

* The next case of swine plague in this pen died June 29, over two months after the death of No. 392.

subsequently. January 25, 1887, injected into each thigh about 2 cubic centimeters from a beef infusion peptone culture, one day old, of swine plague bacteria, obtained from an Iowa outbreak. For several days after the hind limbs were stiff, appetite poor, but the animal fully recovered. March 28, it was transferred with some others to a pen infected with swine plague and with hog cholera, as subsequent deaths showed. Two weeks after the animal began to fail and died April 20.

Skin along median line of abdomen deeply reddened. Subcutis over same region and sides, and subperitoneal tissue dotted with numerous pale-red spots of extravasation. Liver cirrhotic, contracted, pale. *Digestive tract*.—Mucosa along greater curvature of stomach dotted with small extravasations. Near cardiac orifice the small diverticulum contained from fifteen to twenty yellowish-white excrescences, round, removed with difficulty, and leaving a raw, depressed surface (diphtheritic). Cæcum and upper two-thirds of colon pigmented. In the latter the summits of about seven transverse ridges were covered with a very thin sheet of necrosed tissue.

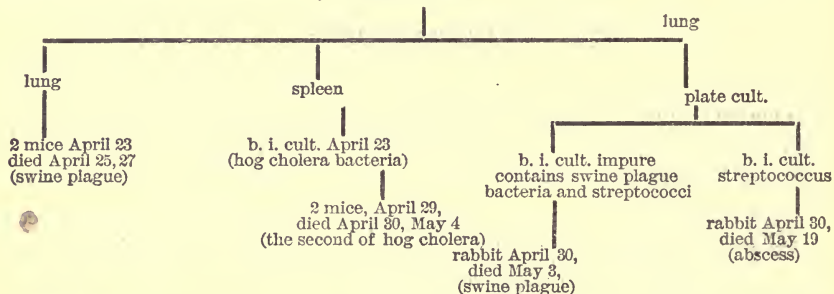
The lungs are the seat of recent and extensive disease. The ventral and cephalic lobe and ventral region of principal lobe of both lungs, as well as the small azygos lobe, are airless, of a deep red, mottled with pale-yellowish dots as in former cases; these dots correspond to the alveoli filled with exudate.

The disease is farthest advanced in the ventral and cephalic lobes. Here the lung tissue is interspersed with hard, yellowish-white nodules, from the size of a pin's head to that of a pea. Cover-glass preparations from the various diseased lobes show numerous forms of bacteria, no one predominating. The remaining portions of the lungs on the dorsal aspect are cedematous; a frothy liquid rapidly fills up the section. Scattered over the entire surface of both lungs are subpleural ecchymoses. These are characteristic of hog cholera in its most acute form.

The inoculations are given in the appended table and may be very briefly summarized. Plate cultures from lung tissue gave two forms, the bacteria of swine plague and streptococci, mentioned in former cases. A rabbit inoculated from a mixed culture of these two forms died in four days. The various cultures of internal organs of this animal contained the swine plague bacteria only. Another rabbit inoculated from a pure culture of the streptococcus died in twenty days from an abscess due to the inoculation. Two mice inoculated with lung tissue died. In one the bacteria of swine plague were found in large numbers. Of three cultures of the spleen of the pig only one became turbid. This contained hog cholera bacteria only, as shown by the microscope and inoculation of mice.

This pig had therefore the bacteria of two diseases, the lung lesions belonging to one, the various hemorrhagic lesions, ecchymoses, etc., belonging to the other.

Pig No. 392.



During March and April a few animals placed in the infected pen in which the virus of both diseases had been scattered no longer took swine plague, but succumbed to hog cholera, as the following notes clearly indicate:

Pig No. 390, placed in the infected pen March 22, with pigs which subsequently died from lung disease as well as hog cholera. The animal died quite suddenly April 6. On examination the spleen was found very large, due to engorgement with blood. A moderate number of hog cholera bacteria present. Fundus of stomach considerably reddened. In the large intestine the mucosa is studded with irregular masses simulating ulcers; most of them seem to be adherent fecal masses. A few, when removed, leave a slightly depressed surface. Glands of meso-colon reddened; lungs normal, with the exception of a few scattered lobules, which are collapsed. No swine plague lesions observable.

The hog cholera bacteria were obtained in pure cultures from the spleen. Their

specific nature was tested by inoculation into mice, both of which died on the fifth day with characteristic lesions.

Pig No. 386 was transferred to the infected pen at the same time. It became affected after a three weeks' stay in the infected pen, and died of hog cholera April 15. From the spleen the specific bacteria were obtained as pure cultures, and inoculation into mice produced the characteristic disease.

Pig No. 366 is another instructive case in which the two diseases were present. The animal had been put into a pen in which swine plague had to all appearance died out two months ago, but in which pigs were dying of hog cholera at intervals of a few weeks.

This animal had been inoculated into the lungs through the chest wall on October 30, 1886, with one-half cubic centimeter of liquid culture of swine plague bacteria, obtained originally from Sodus, Ill. A pig inoculated subcutaneously at the same time died from its effects, but the former showed no signs of disease excepting a general unthrifty condition. The animal did not increase in size. As late as June 4, 1887, it was transferred to the pen above mentioned. It was injured by fighting with other pigs in the same pen June 21. Up to this time no change could be observed. It became very weak and died June 29, twenty-five days after exposure.

Autopsy immediately after death. Skin slightly reddened over pubic region; lymphatics but very slightly enlarged and congested; spleen enlarged, friable. In the cæcum and upper colon are from 12 to 15 small ulcers from one-quarter to one-eighth inch across. The mucosa itself is quite deeply congested.

The whole pleural surface of lungs lightly glued to chest wall; the attachment being readily severed, the pleura is found covered with a pale yellow exudate. The odor from the thorax is strongly putrefactive. The pericardium is thickened and everywhere adherent to the heart. The various lobes of the lungs are glued together by a scanty exudate. The ventral and cephalic lobe and the ventral (ventro-cephalic) portion of the principal lobe of each lung solidified. The remaining dorsal portion is dark red, hypostatic. Trachea and bronchi filled with yellowish foam.

The right cephalic and the ventral lobe have a yellowish-white appearance. On section the tissue is found transformed into a homogeneous mass cutting like dry cheese. These caseous masses are distributed as isolated nodules from the size of a pea to that of a bean, or else in the form of a thick net-work including dark-red, hepatized groups of lobules. The left cephalic lobe has not yet advanced to this caseous stage. In the left ventral lobe the process is begun as whitish arborescent lines with occluded bronchioles and alveoli. The thickened pericardium being removed, the surface of the heart was found covered by a firmly adherent deposit about 1 millimeter thick, villous, scraped away with difficulty. Over left ventricle a rather pale clot one-half centimeter thick.

These lesions indicated a severe form of swine plague. The intestinal ulcers pointed to the existence of hog cholera also. This was to be expected, since the pen was thoroughly infected with the latter disease. The bacteriological investigations demonstrated the presence of both micro-organisms, the bacteria of hog cholera in the spleen, those of swine plague in the lung tissue and pericardial cavity.

Cover-glass preparations from the hepatized lung tissue show immense numbers of bacteria, chiefly oval in form. A moderate number were found in the epicardial exudate. A rabbit and three mice were inoculated with a little semi-fluid matter scraped from a cut surface of the hepatized lung tissue, the former in the ear, the latter beneath the skin of the back; a fourth mouse was inoculated from the epicardial exudate. The rabbit died in forty-eight hours, apparently well a few hours before death. At the point of inoculation on both ears a small abscess, the pus containing long spore-bearing bacilli. Intense peritonitis. A thin, whitish, pasty layer covers the liver, spleen, and cæcum. The latter and portion of the colon covered thickly with sub-peritoneal hemorrhagic points and patches. Lungs œdematous. The peritoneal exudate contained immense numbers of oval bacteria. In the blood none could be found. A gelatine tube culture from the former and a beef infusion culture from the latter contained the characteristic swine plague bacteria. These had thus been isolated from the various putrefying forms by passing through the body of the rabbit.

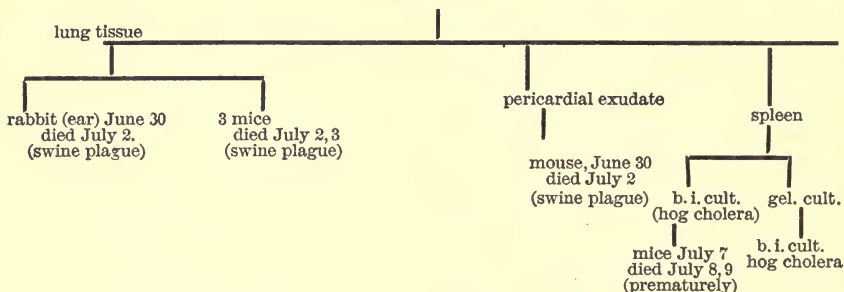
The three mice inoculated from lung tissue died, two on the second and one on the third day. The latter, owing to the great heat, was already decomposed, having died during the night. The blood of the other two contained only the swine plague bacteria; roll cultures* made therefrom confirmed this. The fourth mouse

* Roll cultures are made by coating the inside of test tubes with gelatine which has been inoculated with bacteria to be studied. For a description of the method see *E. Esmarch, Zeitschrift für Hygiene*, I, 293. This more convenient method had to be used, owing to the very high temperature of the laboratory in summer when all cultures in gelatine had to be kept in a refrigerator or "cold box." The ordinary plate cultures occupy too much space.

died next day. A gelatine and a liquid culture were both pure, containing only swine plague bacteria. At the same time the presence of these bacteria in the pericardial cavity of the pig was demonstrated by roll cultures. The presence of swine plague bacteria in both lungs and pericardium was thus amply proved. The latter was also invaded by other bacteria, a vibrio and a streptococcus being among the number.

Although microscopical examination failed to reveal any bacteria in the spleen of this animal the characteristic motile hog cholera bacteria were obtained from it in both gelatine and liquid cultures. The colonies in the gelatine tube were very few in number. Two mice inoculated therefrom died rather prematurely in twenty-four and forty-eight hours, respectively, with the specific bacteria in the spleen.

Fig No. 366.



Within several days of the death of this animal two pigs which had been placed in the same pen died of acute hog cholera, without any hepatization of the lungs.

Pig No. 414 was placed in the infected pen June 21, for the purpose of keeping up the disease of hog cholera, which was apparently dying out. The animal died July 6, after appearing dull for a few days. At the autopsy the lymphatic glands were found but slightly affected, spleen enlarged and very much congested. Lungs normal, excepting a few subpleural petechiæ. Cæcum and colon covered with a large number of ulcers, the mucosa of the latter intensely congested. The same was true of the greater curvature of stomach. Very few hog cholera bacteria in spleen. A pure culture was obtained therefrom.

Pig No. 416, put into the infected pen with No. 414, showed signs of disease July 4, and died on the same day. Skin of abdomen deeply reddened. Lymphatic glands with cortex hemorrhagic. Spleen very large and gorged with blood. Lungs and heart normal, with exception of a few subpleural ecchymoses. Numerous petechiæ on surface and in parenchyma of kidneys. Light hemorrhage into pelvis. Numerous subperitoneal ecchymoses on the large and the small intestines. Besides a general congestion of the mucosa of the latter there are a few small recent ulcers in cæcum and colon. Hog cholera bacteria quite numerous in cover-glass preparation from spleen. A pure culture obtained therefrom.

These three cases show that in the same pen two animals may be in contact with a third which has very extensive lung disease and not take the disease. It is barely probable that the period of exposure to the living animal, about eight days, was too brief a time for the transmission of the disease, or else the time elapsing between the exposure to this disease and the death of the animals from acute hog cholera was too short to allow the lung disease to make its appearance. We know as yet too little of this disease to offer anything but opinions concerning its origin and communicability.

The source of the lung disease in the first animal (No. 366) is likewise very puzzling, when we consider that a number of animals had died of hog cholera without any sign of lung disease.

BRIEF SUMMARY OF THE FACTS OBTAINED FROM THIS EPIZOOTIC.

In the fifteen animals which died there was extensive disease of the lungs, excepting in the first (No. 406), which was very likely a case of hog cholera. In most of these the pleura was also involved. In the earliest four cases, excluding the first (Nos. 403, 402, 405, 407),

there were lesions of the large intestine, of the character of an exudate, of a partly croupous, partly diphtheritic character. In the two succeeding (Nos. 408, 409) there were ulcerations, shallow but extensive, differing from the more penetrating hog cholera ulcers. In the remaining cases (excepting No. 396) the intestinal lesions consisted of extravasation, pigmentation, and ulcers which were very likely hog cholera ulcers. In No. 396 the croupous exudate preponderated.

As regards the bacteriological examination, the first case (No. 406) was not examined. Of the remaining fourteen, nine contained swine plague bacteria. These were obtained either directly from the pleural exudate or from rabbits and mice by inoculating them from the diseased lung tissue. Of those from which no swine plague bacteria were obtained it will be noticed that the lung disease was far advanced. The lung tissue was either converted *en masse* into a homogeneous mass like cheese, or else the latter was sprinkled through the lung tissue in smaller masses. It must also be remembered that the absence of swine plague bacteria should not be inferred from the inoculation of a minute quantity of diseased lung tissue. It seems, however, very probable that in this advanced stage of degeneration the original pathogenic bacteria have been in greater part destroyed. In the later cases (Nos. 409, 372, 397, 396, 392, 366) hog cholera bacteria were also present, as determined by culture and inoculation experiments.

How can we interpret these results? Swine plague in a very acute form had attacked the herd, and in earlier cases this disease appeared in an acute uncomplicated form. This is indicated by the peculiar intestinal lesions (Nos. 402, 403, 405, 407). The two succeeding cases (Nos. 408, 409) were more advanced and less severe; the intestinal ulcers, shallow and broad, were the result of the diphtheritic exudate, which had passed away. The lung tissue was in part dead. In the remaining cases the characteristic swine plague lesions disappeared from the intestine, and the lungs showed a more advanced state of cheesy degeneration. The progress of the disease from a very acute to a chronic form, due most likely to a gradual degeneration of the virulence of the bacteria, is thus very well illustrated. In these later cases hog cholera bacteria are found in the spleen, and more rarely in the thoracic organs. The last cases died of acute hog cholera, with lungs normal. The exact part which the hog cholera bacteria played in the last swine plague cases can not be formulated. It seems to me that they were an attenuated variety which found a place in the organisms because the latter were diseased, and that they grew in virulence until they were able to produce (a month later) the acute hemorrhagic form of this disease. There seems to be nothing so convincing of the gradual increase and decrease in the virulence of these two species of bacteria as the careful observation of a single epizootic from the beginning to the end. The mechanism of this change of virulence is important enough to warrant prolonged study.

There were a few cases that deserve special mention. Nos. 405 and 407 (Plates I, II) were perhaps the most typical of the acute, uncomplicated form of the disease. No. 410 is instructive, in that the disease seems to have spent its force chiefly upon the skin, leaving the lungs comparatively intact. The large size of this animal (the largest that died) may perhaps account for the shifting of the disease to the skin.

The introduction of hog cholera after the appearance of swine plague was most likely due to the case first reported in these pages (No. 406).

ATTEMPTS TO PRODUCE SWINE PLAGUE WITH PURE CULTURES.

A number of experiments were made which were designed to demonstrate, if possible, the specific nature of the bacteria obtained from diseased lungs. A reproduction of the disease after the introduction of the bacteria contained in pure cultures into the lung tissue itself must be regarded as conclusive evidence.

The following means of infection were tried:

(a) *By exposing pigs to a spray of culture liquid.*—February 17 Nos. 398, 400 were placed in a tight box, 3 by 4 by 2 feet, with a glass top. A spray was allowed to play into the box from an atomizer, the nozzle of which was introduced through a small hole in the side near the top of the box. The spray thus played across the top of the box, and was continued for two hours on two consecutive days, 300 cubic centimeters of culture liquid being used each time. The culture was an infusion of beef, in which the swine plague bacteria (from an Iowa outbreak) had multiplied at 95° F. for two days. For several days after respiration was somewhat labored, and for nearly a week they ate very little. Subsequently, however, they fully recovered.

Nos. 393, 394 were exposed March 3 to a spray in the manner described. The culture was made in beef infusion and was one day old. The swine plague bacteria were from the Washington outbreak. The spraying was continued for one and one-fourth hours, several hundred cubic centimeters (about one-half pint) being used. No symptoms of lung disease followed the spraying. No. 393 was killed April 28, nearly two months later, and found perfectly sound. No. 394 was exposed to hog cholera April 30, and died of the acute hemorrhagic form of this disease May 17. The lungs were not hepatized but dotted with numerous subpleural petechiae, characteristic of acute hog cholera.

Spraying and feeding cultures both had thus far proved ineffectual in reproducing any lesions in the lungs or the intestinal tracts. Other modes of introducing the virus were therefore tried.

(b) Two pigs (Nos. 383, 385), one of which had been fed with hog cholera and the other with swine plague cultures December 19, 1886, were perfectly well March 16, on which day 5 cubic centimeters of a liquid culture of swine plague bacteria was injected into the trachea of each. Owing to the thick layers of fat in the neck, intratracheal injection could only be practiced by cutting down to the trachea, raising it with the finger, and then introducing the needle of the hypodermic syringe. After the operation the animals were dull and refused feed for one or two days; after that they were fairly well. The incisions meanwhile healed up. April 28, nearly one and one-half months after the inoculation, No. 385 was killed. The organs were normal; no lung disease manifest. No. 383 was exposed to hog cholera in an infected pen April 19, more than a month after the tracheal injection. It had been apparently well during this time. It died May 11 of acute hemorrhagic cholera. The autopsy notes being recorded elsewhere, it suffices to state that the lungs were covered, as is common in this disease, with large subpleural ecchymoses. There was no hepatization suggesting swine plague. On April 4 two pigs (Nos. 389, 401) re-

ceived into the trachea each 5 cubic centimeters of a beef infusion culture of swine plague bacteria about two days old. On the following day both were well. On April 27 No. 389 was killed and found healthy. No. 401, killed April 28, had likewise remained unaffected by the inoculation.

(c) At the same time, and with the same culture with which Nos. 383 and 385 were inoculated, two pigs (Nos. 352, 388) were inoculated directly into the lungs through the chest wall. No. 352 received 24 cubic centimeters into the right lung with a hypodermic syringe, the skin having been previously disinfected with a one-fifth per cent. solution of mercuric chloride. No. 388 received 5 cubic centimeters in the same way. Both animals lost the use of their limbs, especially the posterior, within a day after the operation, remaining more or less paralyzed until the animals were killed, April 26. In the mean time they ate but little, while there were no symptoms directly referable to lung disease. Shortly before they were killed they had almost gained control of their limbs.

Autopsy of No. 352.—Right lung firmly adherent to chest wall and diaphragm by means of dense fibrous tissue. Left lung adherent in a few places. On the lateral aspect of the left lung an oval mass as large as a small fist was found inseparably attached to it. This mass fluctuates, and when cut consists of a dense fibrous wall one-eighth inch thick, its inner surface deep red. The contents of this sac were of a putty-like consistency, greenish white, surrounded by a turbid fluid containing small flakes. The mass consisted of degenerated pus corpuscles, in which were disseminated the swine plague bacteria in moderate number. The lung tissue was merely compressed by the tumor-like mass and not diseased. A gelatine tube culture inoculated from the caseous contents of the abscess contained an immense number of colonies of swine plague bacteria in each needle track. The absence of other micro-organisms proves that the abscess was the result of the presence of the injected bacteria. The other organs were normal. Cultures from the spleen remained sterile.

In No. 388 the pleuritic adhesions of the right lung are the same; the left lung free. Along the lateral edge of the principal lobe of the right lung are two tumors, one as large as a horse-chestnut, the other, contiguous with it, about the size of a marble. The walls and contents as in 352. A liquid and a gelatine tube culture from the contents contain the swine plague bacteria only. In the latter the colonies were innumerable in each needle track. The bacteria had therefore not only lived for forty-one days, but had multiplied enormously, causing the lesions described.

On January 25 Nos. 391 and 392 received into the subcutaneous tissue of the thighs 4 cubic centimeters of a beef infusion peptone culture about twenty-four hours old. The swine plague bacteria were obtained from an Iowa outbreak reported in 1886.

No. 391 became lame soon after, probably from handling. Its appetite, poor at first, was restored after a week. February 18 it was killed, but no lesions were found, excepting circumscribed abscesses on the thighs at the points of inoculation.

No. 392 has been dwelt upon in the preceding pages. It did not show any symptoms referable to the inoculation. When exposed in an infected pen it died, being found with extensive disease of the lungs. Hence the inoculation was in no sense protective.

Pig No. 387, after a fast of more than twenty-four hours, was fed March 8, with about 200 cubic centimeters of a beef infusion culture

of swine plague bacteria, the culture being about three days in thermostat at 95° F. No disturbance whatever followed this feeding. The animal was subsequently exposed to hog cholera (April 19) and died of the acute form of this disease.

There is nothing to be added to the description given in the preceding report of the Bureau of the microscopic and biological characters of the microbe of swine plague as obtained from the various outbreaks. There is, however, a very marked difference observable in their pathogenic effects. The organisms obtained from Sodorus and Geneseo, Ill., in the summer of 1886, both acted alike, while those from Iowa and from the District of Columbia, studied in the winter of 1887, also acted alike, but different from the two former. In the preceding report a number of cases are cited in which subcutaneous injections of cultures from the two first sources produced in pigs a very marked sclerosis of the liver, with pronounced icterus. Neither the organisms injected nor any other were found in the organs after death. Fowls were also killed by large doses and presented extensively local lesions. The organisms from the two latter sources had no effect upon pigs when injected hypodermically, even when very large doses were given. Fowls were likewise undisturbed after inoculation. On rabbits the difference was also noticeable. Inoculations of bacteria from the first class usually produced an extensive plastic peritonitis, lasting nearly a week before the animal succumbed. Inoculations of bacteria from the second class produced invariably a septicæmia, fatal within twenty-four to seventy-two hours. Peritonitis was either absent or barely manifested. Whether this difference is due to an inherent difference in the bacteria or to surrounding circumstances, such as temperature, attenuation due to cultivation, etc., can not be determined at present.

REMARKS ON THE CAUSATION OF SWINE PLAGUE.

The difficulties attending investigations of diseases which have their seat in the lungs, and which are presumed to be caused by specific bacteria, are due to the accidental presence of various other parasites. The air, as it is drawn into the lungs, carries with it the organisms suspended in it. From the mouth, which contains many bacteria, some may be carried accidentally into the air tubes with the saliva or food.

When disease germs have obtained a foothold and produced a destruction of tissue or an infiltration by which the vitality of the tissue cells has been greatly reduced, other bacteria may also gain a foothold and multiply, although this may have been impossible in a normal lung.

In examining sections of diseased lung tissue different forms were found, no two lungs showing the same micro-organisms. Among those which were found several times was a streptococcus, appearing in the alveoli in the form of long chains. These chains were imbedded in the mass of cells which filled the alveoli. In some sections groups of cocci, in others masses of bacilli were observed. Finally in the early stages bacteria were very scarce, and if the disease ran a very rapid course only the bacteria, which we regard as the cause of this disease, were present in large numbers. When portions of the lung tissue died and then appeared as homogeneous masses imbedded in diseased but still living tissue, bacteria of every

description could be observed in these dead masses and the lung itself usually emitted a putrefactive odor.

In the interpretation of these sections under the microscope we must be very careful in assigning any particular rôle to the bacteria present. Most of them are there because of the previously existing disease, which, so to speak, prepared the soil for them. In the second place the bacteria, which are in reality the cause of the disease, may be present only at a certain stage of the disease, being subsequently destroyed as the lungs heal, or giving way to accidental forms as the disease progresses. We must bear in mind with reference to the second alternative that pathogenic bacteria must suffer by the gradual changes which they themselves induce. Thus in the early stages they undoubtedly live and multiply in the exudate which is contained in the alveoli. When this becomes more and more consolidated, and as the ultimate bronchi are occluded by exudate, the bacteria are being deprived of nutriment and oxygen. The tissue dies, and with it the bacteria originally causing its death; other bacteria more adapted to the conditions now prevailing get a foothold, until the entire lung becomes a prey to many kinds of bacteria.

A well-known illustration may be cited in support of these assertions. The tubercle bacilli, which may be seen in sections of young tubercles, can not, as a rule, be found in the caseous mass which forms later on in the center of the enlarging tubercle. Inoculations of blood serum with such material are apt to prove failures, and if it were not that inoculation into guinea pigs is almost invariably successful we might presume that the bacilli had perished. The fact is, the bacilli, finding no suitable conditions of growth in the caseous mass, would perish if it were not that they have the capacity to form spores under such circumstances. These spores, which may fail to germinate on blood serum, find a more suitable medium in guinea pigs, where they soon give rise to a generalized tuberculosis.

The problem to be solved, therefore, was to isolate the specific bacteria which are the cause of the disease from the rest. The method pursued was to introduce minute bits of diseased lung tissue beneath the skin of rabbits and mice. If the specific bacteria are present they will in all probability cause the death of the inoculated animals. They will then be found in one or more of the internal organs, from which they can be obtained free from the other bacteria. These will remain restricted to the place where they were deposited. This method of obtaining disease germs has been used by other investigators, more particularly by Schütz, in the study of swine plague in Germany, and more recently in investigations of infectious pneumonia in horses. A résumé of this work on the bacterium causing swine plague has been given in the preceding report of the Bureau in connection with the preliminary investigations made last year of American swine plague. The facts in the case are briefly as follows: It was found that in the majority of cases, when bits of diseased lung tissue were placed beneath the skin of rabbits and mice (or simply rubbed into any slight prick made on the ear with a lancet), a septicæmia appeared with which the bacteria described in the preceding report were always and exclusively associated. Rabbits are more susceptible than mice, and die in from one to four days after inoculation. By this means pure cultures of the same bacteria were obtained from most of the cases reported in the preceding pages. This was therefore the only microbe present which was capable of destroying the smaller experimental animals.

It may be argued that bacteria obtained in this way may be accidentally present in the diseased lung tissue, and that the bacteria which are the real cause may not produce any disease whatever in the experimental animals. Without entering at present into any detailed statement of the other arguments in favor of this bacterium as the cause of swine plague we may state that most of the bacteria which produce diseases in the higher animals are fatal to mice or rabbits or guinea pigs, or all three. We need only to mention anthrax, black quarter, tuberculosis, fowl cholera, *rouget* among swine, hog cholera, glanders, the German swine plague, and infectious pneumonia in horses. And the converse may also be assumed as true that any bacteria which are harmless to these experimental animals are, as a rule, not the cause of virulent diseases among higher animals.

In one of the cases given in the preceding pages in which the disease had involved the pleura, pure cultures of this bacterium were obtained from pleural effusion, while it was obtained from the lung tissue by inoculating rabbits with bits of the tissue as above described. This case, therefore, is worth a host of negative ones, for we can not but believe that if the disease enters a closed cavity, like that of the thorax, the bacterium there found exclusively is the cause of the process. In a subsequent case the same organism was obtained from the diseased pleura, but mingled with two others, a chromogenous bacillus found in cases of hog cholera several years ago, entirely harmless, and the streptococcus already mentioned. The lungs in this case emitted an unpleasant odor.

The streptococcus was isolated after much difficulty and more carefully examined. It requires a higher temperature for its growth on gelatine, so that plates made during the winter months were as a rule unsuccessful. It grows quite well in nutrient gelatine at a temperature of 75° to 80° F. The colonies in the depth of the gelatine are spherical, whitish; the surface growth is very scanty. In liquids the growth is quite peculiar. The culture liquid remains entirely clear, but a number of white flakes appear usually in the bottom of the tube, occasionally on its side when the tube remains in an inclined position. These flakes do not grow larger than 1 to 2 millimeters in diameter. Under the microscope they are seen to consist of masses of interlacing chains of cocci. This accounts for the permanently limpid condition of the culture fluid. It serves at the same time as an important aid in determining the purity of a culture. This description applies to beef infusion. When 1 per cent. peptone is added the flakes are much larger and the deposit becomes quite abundant. The liquid remains clear. They do not grow on potatoes.

When milk is inoculated its appearance remains unchanged.

In sections of the lung tissue they are brought out very neatly by Gram's method, and the chains can be readily followed by focusing as they wind through the cellular exudate in the alveoli. This property of retaining a deep-blue color after the application of iodine solution is retained by the cocci when under cultivation. The individual cocci are slightly oval, the longer diameter being about .8 micromillimeters. They strikingly resemble the bacteria causing swine plague in exhibiting two stained extremities joined together by a median, unstained, very narrow zone. They are, however, very readily distinguished from swine plague bacteria. The latter are much smaller, do not retain the stain when treated according to Gram's method, and never appear in chains. The uncolored zone may be looked upon as a stage in the process of division of a single coccus into two cocci.

The pathogenic power of this organism was tested by inoculating one-twelfth cubic centimeter of a pure, liquid culture subcutaneously into two rabbits and two mice. Both mice were found dead on the morning of the second day. One, being partially decomposed owing to the heat during the night, was not examined. In the other there was at the point of inoculation a slight, reddish, serous infiltration containing numerous streptococci. There were a moderate number in the spleen and blood from the heart. In a gelatine tube culture made from the latter a number of colonies of streptococci appeared after a few days. In the beef infusion tube a small number of minute white masses appeared after three days, floating in a perfectly limpid liquid. These were made up of interlacing chains of cocci. The two rabbits remained well. When killed after fifteen days one of them was found infested with

cysticerci. There was a small, softened, whitish mass in the muscles of the thigh at the place of inoculation. The second rabbit, perfectly well up to the twenty-fourth day, was then inoculated on both ears with a bit of lung tissue from swine plague, to which it succumbed in a few days.

Cultures of this microbe were injected beneath the skin, into the thorax, and into the trachea of pigs without causing any disturbance. It therefore had but slight pathogenic properties, and no further attention was paid to it. It may be that it is the streptococcus pyogenes found occasionally in abscesses.

In some cases when the powers of life are much reduced and the destruction of the lungs is far advanced, the same bacteria which are found entering the pleural cavity may appear in the blood, spleen, and other organs. This was true of No. 392, in which the chromogene there mentioned was found in the spleen as well as in the pleural cavity. In a considerable percentage of the cases given, anaërobic bacilli were found in the cultures from the internal organs. These microbes may have gained entrance by way of the digestive tract (liver) or the diseased lungs in the form of spores and developed under the peculiarly favorable conditions. Death usually takes place by a paralysis of the respiratory function (asphyxia); the right ventricle and large vessels are filled with large thrombi. The system being thus slowly but completely deprived of its oxygen anaërobic bacteria may multiply and appear in cultures. They seem to be butyric bacilli, judging from the odor emitted by the cultures. These bacilli carry on a feeble existence in the lowest strata of liquid cultures and die out very soon.

The presence of the bacterium of swine plague in animals having hepatized lungs has been proved in several outbreaks, some of which have been dwelt upon in the preceding report of the Bureau. They may be summarized briefly as follows: The specific microbe was obtained from the spleen at Geneseo, Ill., July, 1886; from the pleural cavity (as a pure culture) of a pig at Sodus, Ill., September, 1886; from lung tissue (by inoculation into rabbits) sent from Iowa, January, 1887; from a considerable number of cases fully described in this report, studied at the experiment station of the Bureau during the winter of 1887. In all of these cases hepatization of the lungs was present. This organism has never been obtained in cultures from several hundred cases of hog cholera in which extensive lung disease was absent.

The final proof of the causal relation between a given microbe and a disease having definite pathological characters can only be brought by actually reproducing the disease in healthy animals with pure cultures of the given microbe.

In the experiments made with this in view, and detailed in the preceding pages, cultures were introduced into the lungs through the trachea, and pigs were exposed to the spray of liquid cultures. In none of these experiments was the disease reproduced. In two cases, however, the injection of a few cubic centimeters of culture liquid into the thorax produced large abscesses, the contained pus being of a semi-solid caseous consistence. The presence of the injected bacteria in immense numbers proved them to be the cause of these changes. These two cases are by no means positive, but very presumptive evidence that the microbe under consideration is the true cause of swine plague.

There are several reasons why this microbe may not produce the disease when introduced into the lungs by way of the trachea. There may be a rapid attenuation in artificial cultures. But more plausible than this is the theory that in this, as in perhaps the great ma-

jority of lung diseases, the specific bacteria can not gain a foothold unless there be some disease already existing which has been produced by exposure or parasites, or both. It is a well-known fact that it is more difficult to produce diseases of a general character like anthrax by introducing virus through the trachea into healthy lungs than by subcutaneous inoculation, as the air passages are well provided with means for resisting the entrance of foreign particles.

Schütz, in his investigations of swine plague in Germany, was able to reproduce the disease by exposing pigs to the spray from culture liquids simply because he had a more virulent microbe to deal with. He produced, for example, a general septicæmia in pigs by the subcutaneous injection of cultures. Numerous subcutaneous inoculations made with cultures at the experiment station of the Bureau have in no case produced septicæmia. We must not expect any microbe to grow in the blood and internal organs of healthy inoculated animals when it appears there only in rare instances and in very few numbers in animals spontaneously affected with the specific lung disease, and moreover with the whole system greatly debilitated thereby. In his investigations of infectious pneumonia in horses Schütz* reproduced the disease with cultures of the specific microbe by direct injection of culture liquid into the lungs through the walls of the thorax. In a second experiment made by spraying a large quantity of culture liquid through a tracheotomy tube directly into the bronchi the lesions found on killing the animal proved less positive.

Careful observations of the lungs in pigs which have died of hog cholera, of those which have been killed, apparently in good health, and of those of very young animals which died of exposure or lung worms, lead us to conclude that unless the bacteria of swine plague happen to be of exceptional virulence, some slight lung disease, such as atelectasis or lobular broncho-pneumonia, must furnish the starting point from which the remainder of the lung tissue is attacked. In the preceding article on hog cholera this has been dwelt upon more at length. There it has been shown that in at least one season of the year, the fall, collapse and lobular pneumonia, lung worms, and bronchitis are very common in young animals. When an epizootic is very severe, and such seem to be quite rare, the healthy lungs of even adult animals may be attacked. Of this state of affairs the epizootic described furnishes a good illustration.

SOME OBSERVATIONS ON THE GENERAL CHARACTER OF SWINE PLAGUE.

To understand the character of this disease, its mode of invasion and particular seat, a brief description of the pig's lung is necessary:

When inflated through the trachea after the sternum is removed, and while it is still in its natural position in the thoracic cavity, it will be observed that the surface resting against the ribs laterally is the most extensive. That surface resting upon the diaphragm comes next, while the ventral aspect is the smallest.

The right lung is made up of four lobes; the left has only three. (In text-books on anatomy the left lung is considered as being made up of only two.)

In both there is a large principal lobe resting upon the diaphragm and against the adjacent thoracic wall. This lobe forms the major part of each lung. The remainder, occupying the anterior (or cephalic) portion of the cavity, is made up of two small lobes, one extending ventrally (or downward in the standing position of the

* *Die Ursache der Brustseuche der Pferde.* *Archiv für pathologische Anatomie* (1887) CVII, p. 356. *Archiv für wissenschaftliche und praktische Thierheilkunde* (1887) XIII, p. 28.

animal) and in the expanded state covering the heart laterally, the other extending towards the head and overlapping the base of the heart. These small lobes may be denominated the ventral and cephalic lobes, respectively. The right cephalic lobe is longer and more distinct from the ventral lobe than the corresponding left cephalic. Wedged in between the two principal lobes and resting on the diaphragm is a small lobe, pyramidal, belonging to the right lung (azygos lobe). This lobe rests on the left against the mediastinal membrane, and on the right it is separated from the right principal lobe by a fold of the pleura passing from the ventral abdominal wall to inclose the inferior vena cava. This small lobe is almost completely shut off, therefore, from the other lobes by folds of the pleura.

When the trachea and its branches have been examined it is easier to understand this division into lobes. The trachea divides in the thorax into two principal branches or bronchi. These bronchi pass into the principal lobes, straight to the caudal border, giving off a number of small branches along their course. Very near the place of bifurcation the left bronchus gives off a large branch, which ramifies in the substance of the left ventral lobe. From this branch another goes to the cephalic lobe. In some lungs the branches for these two lobes arise together by a very short, scarcely perceptible trunk, and are of nearly equal size. The bronchial supply of the right lung differs materially from that of the left. About 3 centimeters from the bifurcation the trachea gives off a small bronchus, which supplies the right cephalic lobe exclusively. At the bifurcation the right bronchus sends a branch to the ventral lobe. A short distance from this the same bronchus sends a short branch to the small median or azygos lobe.

These brief remarks will be sufficient to give a general idea of the gross anatomy of the pig's lung. The manner in which the air tubes branch gives us a clew as regards the invasion of the disease itself. The bacterial virus entering the trachea first enters the air tubes supplying the ventral and cephalic lobes. These become consolidated. It then enters the air tube of the small median lobe, and then it invades the smaller branches of the principal lobe nearest the trachea. This is the farthest point to which we have seen the disease advance before the animal succumbed.

A careful inspection of the autopsy notes will show that this is the course of the invasion. No case has yet come to our notice in which the ventral lobes were normal, while the principal lobe was in part consolidated. In many of the cases the disease was cut short by the death of the animal before it had reached the principal lobe. It would be interesting to know whether or not the right cephalic lobe, which is the first to receive its bronchus, and moreover directly from the trachea, is first affected. It is difficult to decide this matter, as the animals do not die until the disease has made some headway. It is a matter of common observation that in collapse and catarrhal conditions the ventral lobes are chiefly involved. But there is another peculiar feature which will explain the location of the disease much better. When the lungs are taken from the thorax and held in the position which they occupy in the standing animal, the line of demarcation between the diseased and healthy lung tissue is nearly horizontal, all below this being consolidated. If gravity has any influence upon the virus in selecting its place of attack, we should expect to find the ventral lobes first involved, next the cephalic, and lastly the ventral portions of the principal lobes and the median lobe. This course is nearly the same as that given above when the bronchial supply was discussed. We have not yet seen lungs in which the uppermost portion of the principal lobes, *i. e.*, on either side of the vertebral column, was involved. When the disease progresses it is upward, *i. e.*, towards the back-bone of the animal, invading the still spongy tissue by lobules and groups of lobules.

If we put together the facts brought out in the preceding pages we can construct a theory as to the manner in which the virus enters

the lungs. The course of the invasion shows that the virus is not inhaled with the air, that it is not suspended in the air as a living germ, otherwise it would be difficult to explain the peculiar localization and the slowly progressive nature of the disease. A virus imbedded in some liquid vehicle will perhaps explain all the facts most satisfactorily. Its slow movement from bronchus to bronchus, its limitation by gravity to the most dependent portions of the lungs at first, and its extension upwards as it gains upon the vitality of the lung tissue, all accord with this theory. At the same time it harmonizes with the fact that the microbe causing the disease can not survive drying for even a single day.

In this disease the lungs are primarily the seat of the virus, and in them the greatest changes are observable. The lesions are those of a broncho-pneumonia. The pleura is secondarily involved over the seat of the disease when this extends to the surface of the lungs. The great variety in the appearance and extent of the lesions as manifested in different cases may be brought together under a few heads for description.

The most severe types of disease are encountered at the beginning of an epidemic, and may be conveniently denominated acute. Plates I and II are illustrations made from the right lung of pig No. 407, described in the preceding pages. As may be seen, there is extensive pleurisy accompanying the pneumonia. The disease is characterized by a solidification of the ventral, cephalic, and median lobes, and a portion of the principal lobe, usually of both lungs. The diseased lobes are moderately expanded, so that the thorax seems almost filled up with lung tissue when the sternum is removed. The hepaticized portion has a bright blood-red color, when viewed from the surface, as well as on section. The surface in many cases has a peculiar mottled aspect, shown in Plate III, fig. 2. The bright-red ground is dotted with closely set, grayish-yellow points, arranged quite regularly in groups of four, occasionally of three. These points are not sharply defined, but hazy. When examined with a lens this haziness is well marked. This grayish mottling does not appear everywhere on the diseased lung, but only upon some lobes, and then with striking clearness and uniformity. These points no doubt are the terminal air sacs, or infundibula distended with the cellular exudate. The more leucocytes in the exudate the whiter the injection will appear through the translucent pleura. The bacteria are found imbedded in the cellular masses, which occlude the alveoli. The disease involves the terminal air tubes, as they are frequently found packed with cells. The larger bronchioles and bronchi are the seat of catarrhal changes. The lumen of the tubes is filled with a mucopurulent secretion, usually containing large numbers of bacteria.

The foregoing may be regarded as the early stages of the disease proper. When the invasion is thus extensive and takes place suddenly, the animal speedily succumbs before the disease has had the opportunity of entering upon the more advanced stages. But in perhaps the majority of animals the disease progresses very slowly. It may be that only the ventral lobes are attacked at first, and then only in certain limited areas. The surrounding tissue becomes hyperæmic and often consolidated. The areas first attacked become converted into homogeneous greenish or yellowish white masses, sharply defined from the surrounding tissue. They cut like ordinary hard cheese, and on microscopic examination are found to be made up of dead lymphoid cells and bacteria of all kinds. The process of case-

ation is without doubt caused by the packing of the respiratory tissue with cells, by which the capillaries are compressed and all food supply cut off. The caseous foci vary from the size of a small pea to that of a marble or horse-chestnut. (Plate IV, fig. 1.) They are usually round, rarely irregularly elongated. They are occasionally present in such numbers that the affected lobe feels like a bag filled with small marbles. It is highly probable that now and then the pathologic process may go a step farther. The caseous mass may be separated by secondary suppurative processes from the living tissue, soften, and be discharged through a bronchus, leaving an irregular cavity. We have seen but once what appeared to be cavities in a piece of lung sent to us from the West.

A few lungs have come to our notice in which this process of slow necrosis was not limited to groups of a few or more lobules, but had involved the entire lobe uniformly. The tissue was completely airless and bloodless, of a homogeneous consistency, cutting like cheese, yellowish, with a semi-translucent, waxy luster.

In distinction from the acute type of this disease, the process ending in caseation may be regarded as essentially slow and chronic. It may either be due to a diminished virulence of the bacteria or to a greater resistance on the part of the lung tissue. The former supposition seems to us nearer the truth, and there is much other evidence which points to a rapid attenuation of this specific virus.

The pathological process may be briefly summarized as follows: The bacteria, which have somehow entered the air tubes, begin their destructive activity in the alveoli and ultimate bronchi. A copious exudate, consisting chiefly of desquamated epithelium and round cells or leucocytes, fills them completely. Although the bacteria are finally destroyed by the exudate, the latter impairs by pressure the nutrition of the lung tissue proper, and the whole becomes involved in necrosis. The covering of the lungs is secondarily affected. In acute cases the pleura of the hepatized lobes may be covered with a fibrinous exudate of a spongy texture, containing a considerable number of round cells and bacteria. It may become several millimeters thick, and tends to unite the lungs with the chest wall. The adhesion is at first broken without injury to the lung substance and is quite easily peeled from the pleura itself, as shown in Plate I. Not infrequently the diaphragm is more or less firmly glued to the base of the principal lobe when that is diseased, as is shown in Plate II. The pulmonary pleura and adherent costal pleura may sometimes form cavities between them, containing a yellowish-white, very turbid liquid crowded with bacteria. The adhesions are sometimes very close, the costal pleura having its minute vessels much injected at such spots. In older cases there are bands of fibers, of various lengths and density, bringing about the adhesion. In most cases the pleuritis is dry, with no adhesions. Over the dead lung tissue the pleura may be opaque and thickened or quite transparent, as in health. In several cases in which gangrenous processes were indicated by putrid odors, a generalized pleurisy was found gluing the entire lungs to the chest wall by means of a pasty exudate. In this various bacteria were found, which, very likely, had a share in the inflammatory changes. The pericardium occasionally is involved with the pleura and is subject to similar changes. In but one of the cases (No. 366) thus far examined was the epicardium covered with a fibrinous exudate.

Intestinal lesions.—In the severe types of this disease, there are very extensive lesions of the large intestine. These on superficial examination resemble those of hog cholera so much that this similarity alone may have prevented the separation of these two diseases by pathologists who have studied them very carefully.

Although the lesions seemed to us at first sight different from the ulcerations found in hog cholera, yet it was only after the futile search for the specific bacillus of this disease in the spleen of the affected animals that we ventured to consider them as something entirely different from the lesions produced by that disease.

In the following pages we shall try to state as clearly as possible the difference between the appearance presented by the large intestine in hog cholera and in swine plague.

Croupous and diphtheritic lesions.—The mucous membrane is dotted by a large number of closely set, convex, circular masses of a yellowish tint. These are rarely larger than one-eighth to one-fourth inch in diameter. They can be readily lifted away from the membrane, leaving a slightly depressed, raw surface. This mass which has exuded from the membrane is tough, evidently made up of a fibrinous coagulum. It is very easily mistaken for an ulcer when the examination is carelessly made. The hog cholera ulcer, it will be remembered, is a circumscribed death or necrosis of the mucous membrane. The hole thus made is occupied by a soft, granular matter, in some cases projecting above the surface like a button, which is scraped away with some difficulty, leaving an irregular excavation. Very rarely the ulcers are flat, button-like masses, presenting concentric bands of a dirty yellow and black. They are then made up of hard, tough, homogeneous, whitish tissue, extending at times as a neoplasm through the entire intestinal wall to the peritoneum. These ulcers vary much in size, from a pin's head to an inch or more in diameter. The lesions found in swine plague are therefore different in that they consist of masses of exudate, either isolated or running together into large patches of variable size and thickness. The rectum (rarely diseased in hog cholera) is quite frequently involved with the colon. In some cases a continuous sheet of deposit covers the mucosa entirely. This may adhere with considerable tenacity, or it may be removed simply by the stroke of the scalpel, or it may not be attached, but appear as a part of the intestinal contents. It then consists of small lumps stained with bile and feces and easily overlooked. Sections of the intestinal wall show the exudate to consist of a mesh-work which may or may not inclose leucocytes. When the inflammation is very severe the membrane beneath the exudate is liable to necrosis, and the process must then be regarded as diphtheritic. It is probable that in all cases the epithelium is destroyed in order to give rise to the exudate, and all varieties of lesions, from the simply croupous to the diphtheritic, are to be met with, depending on the quantity and quality (or virulence) of the infectious agent. The anatomical distinction between croupous and diphtheritic lesions seems at least in this disease to be simply due to a more or less intense action of the same cause. In diphtheritic conditions, therefore, ulcers may subsequently appear. Our observations on this stage of the process are too few to warrant any conclusions. Once or twice ulcers were seen which differed from hog cholera ulcers in being perfectly round, as if punched out of the membrane, from one-eighth to three-eighths of an inch in diameter. The bottom of the ulcers was concealed by a thin, creamy deposit,

the border slightly thickened and very red. There was no adherent slough. Some of the ulcers corresponded with the mouths of the flask-shaped mucous glands.

The exciting cause seems to attack the membrane from the surface, for the submucous tissue is not infiltrated with cells to any extent. In hog cholera very extensive infiltration quite invariably accompanied the ulceration, so as to make the intestinal wall very brittle.

In another case the mucous membrane appeared as if gnawed or eaten away in large patches. The diphtheritic deposit and subjacent membrane in state of necrosis had very likely been shed as a slough, leaving the ragged, depressed surface.

The pathological process in the large intestine is distinctly exudative, diphtheritic in swine plague; in hog cholera it is essentially necrotic or ulcerative. In the latter the virus may act not only from the intestine but also from the blood. In the former it perhaps never acts from the blood, but only from the intestine.

The lesions of the intestinal tract are always co-existent with the specific broncho-pneumonia and without doubt secondary to it, because we frequently have encountered lung disease without intestinal disease. The origin of the latter may be accounted for in two ways. The virus enters the digestive and the respiratory tract at the same time, or else it gains a foothold in the lungs first and thence reaches the intestines. This is possible, for the bronchi are filled with bacteria imbedded in a large quantity of purulent mucus, which has come from the diseased alveoli and bronchioles. They may be coughed up into the mouth and swallowed and lodge at first in the mucous glands of the large intestines, where they are well protected while multiplying. The remainder of the mucous membrane may then be attacked if the animal be weak or the virus especially active. The simultaneous attack of lungs and large intestine is perhaps very rare. Feeding pigs with large quantities of culture liquid and with rabbits which have died after inoculation does not produce any lesions whatever. We must therefore consider the lungs the most vulnerable and the intestines only secondarily so. This view is supported by the fact that in the early and most pronounced cases of the Washington outbreak the intestinal lesions were very marked, but disappeared in the progress of the disease. The virus, at first very powerful, became slowly attenuated, being unable to attack the mucous membrane of the intestines and therefore confined to the lung tissue. Intestinal lesions are thus always associated with the severest lung disease, which in turn is characterized by an abundant muco-purulent secretion in the air passages.

Diagnosis.—The disease just described can not fail to be recognized, as it seems to be the only severe disease of the lungs among swine of which we have any knowledge. That exposure may bring on croupous pneumonia we do not deny; but the character of the ordinary croupous pneumonia among animals is such that it can be readily distinguished from the irregular atypical infectious broncho-pneumonia which we have just outlined. It is barely possible, however, that the disease may be confounded with other lesions which we have met now and then in *post mortem* examinations.

Collapse.—The small ventral lobes which hang down on either side of the heart are very frequently collapsed (atelectasis). The affected lobe is small, of a bright red, soft to the touch, but without crepitation.

The tissue is not diseased, as may be seen on microscopical examination. This condition is the result of a plugging of the bronchus supplying the lobe with catarrhal products. The air can not enter the tube, and all the tissue supplied by it remains collapsed. Groups of lobules, permanently collapsed, may be found in other portions of the lungs.

A lobular broncho-pneumonia simulating infectious pneumonia very closely is not infrequently found in young pigs. It seems to follow collapse.

*Lung worms (Strongylus paradoxus).**—Are frequently found in the fall and winter. They first appear in the extreme end of one of the large bronchi, *i. e.*, in the caudal tip of a principal lobe. Here they may be detected as small, hard nodules, not larger than a small pea. The lung tissue around them may be hyperæmic, or perhaps in a state of hepatization. The presence of the worms will in all cases explain the lesions.

More advanced changes are well illustrated by a case which came under our observation recently. Each principal lobe contained four masses about three-fourths of an inch in diameter and very hard to the touch. The cut surface was coarsely granular, the granules yellowish, imbedded in a pale red parenchyma, and probably representing plugs in the smallest air tubes and alveoli. The trachea and bronchi contained large quantities of gelatinous mucus. The bronchi leading to the hepatized regions were completely occluded with lung worms. There was not pleuritis.

In hog cholera the lung lesions are quite insignificant compared with those of other organs. In the acute type there is usually a hemorrhagic condition. The entire surface is dotted with subpleural blood extravasations. On section the lung tissue itself is found to contain these hemorrhagic foci. Excepting the occlusion of a few alveoli here and there with blood, there is no inflammation or hepatization perceptible in any part of the lung tissue.

In chronic cases of hog cholera these hemorrhages either never take place or else they are speedily absorbed, for the lungs are, as a rule, healthy, if we except the collapse of the small ventral lobes now and then encountered as above described.

When, in a case of swine plague, the sternum of a diseased animal is removed the ventral lobes which overlap the apex of the heart only during a full inspiration do not collapse and drop out of sight into the thorax, as in the normal lung, but they stand up over the heart as two solid masses, of a deep red, mottled with yellowish points, or more grayish, according to the stage of the disease. If these lobes are normal the disease, as a rule, does not exist in the remainder of the lung tissue. Frequently they are glued to the walls of the thorax and the pericardium.

The appearance of the lungs will thus lead to an easy diagnosis of swine plague as distinguished from hog cholera. The intestinal lesions which accompany swine plague in its most severe forms are not so easily differentiated from lesions produced by hog cholera, but a careful attention to descriptions given in the foregoing pages will solve this difficulty in most cases. The disease of the large intestine in swine plague is essentially exudative. Necrosis of the superficial layer of the mucous membrane is secondary, the resulting ulcers superficial. In hog cholera the lesions are at first either hemorrhagic or necrotic (ulcerative), or both. There is little or no exudate preceding the stage of ulceration.

* See p. 282 of the Report of the Bureau of Animal Industry for 1885.

SUGGESTIONS AS TO THE MEANS OF PREVENTING THE SPREAD OF SWINE PLAGUE.

Experiments with the microbe of this disease have shown that it has very feeble powers of resistance to external agencies. It is killed by drying within twenty-four to forty-eight hours, and it is speedily destroyed in water. Its life in the soil is no doubt very limited for these reasons. Moreover, it fails to multiply on vegetable substrata, like potato, and grows feebly in most nutritive media. In these respects it differs very markedly from the hog cholera germ, which manifests a very decided resistance to the destructive agencies in water and soil.

It seems probable that infectious matter from swine plague is more directly conveyed from one animal to another than is the case with hog cholera virus. Direct contact of the sick with the healthy must be considered as one of the principal means of infection. The mucus from the lungs contains the disease germs in abundance, and a forcible expiration by which particles of water, etc., are ejected from the nostrils to some distance may easily communicate the disease to another. The soil at the same time becomes infected from intestinal discharges, as with hog cholera, and it is therefore necessary to separate the well from the sick by removing them to uninfected grounds; but the infection of the soil and pens can not live for more than two weeks, and in a month such places may be considered safe.

The same remarks apply to both diseases as regards disinfection. This need not be so thorough in swine plague if the pens or grounds are left unused for a month, and if the healthy be kept away from the sick. At any rate, disinfection should always be practiced if possible. For this purpose lime is perhaps the best and cheapest, and for suggestions as to its use the reader is referred to another part of this report.

There may be some difficulty in determining which disease has attacked a given herd, or whether both are not actually present. Very severe lung disease is now the only sign that is of any positive value in the detection of swine plague, unless it be bacteriological testimony, which is the safest, but not at hand under most circumstances. Where any doubt exists the disease should be treated as hog cholera, and all the rules for disinfection and isolation which have been suggested in this and the preceding report for that disease should be followed out. In the disinfection lime should take the place of the mercuric chloride recommended in the report for 1886.

Whether this disease can be prevented by inoculation requires more evidence than has been obtained thus far, and experiments to test this matter are now going on.

DESCRIPTION OF PLATES.

- PLATE I $\times \frac{3}{4}$.—Swine plague. Right lung of pig No. 407 (see text), showing the lateral aspect. The diseased portion is sharply demarkated from the normal portion and concealed in part by a pleural exudate of a spongy texture.
- PLATE II $\times \frac{3}{4}$.—The same lung, as seen from the ventral aspect. The localization of the disease is well brought out. On the right a portion of the diaphragm is firmly adherent.
- PLATE III, FIG. 1.—Section through lung of pig 407, as indicated by the arrow on Plate I. The thickened pleura, with portion of the lung tissue converted into caseous masses on the left, caseation beginning above.
- FIG. 2.—Portion of lung tissue from pig No. 408, showing the grayish-yellow mottling of the surface; frequently observed in this disease, due to the cellular exudate in the ultimate bronchi and alveoli (broncho-pneumonia).
- PLATE IV, FIG. 1.—Section through the lung of pig No. 396, showing cheesy masses embedded in the lung tissue; frequently observed in advanced stages of the disease.
- FIG. 2.—Portion of the large intestine of the same animal covered with circumscribed masses of exudate; frequently observed in swine plague.
- PLATE V, FIG. 1.—Collapse of various groups of lobules in the principal lobe of a pig's lung. Frequently found in young pigs which have died of hog cholera, in those affected with lung worms, and in a small percentage of those slaughtered during health.
- FIG. 2.—Broncho-pneumonia affecting animals under various conditions and not infrequently found in animals which have succumbed to hog cholera. The air cells and smallest air tubes are shown distended with a yellowish material, which is of a dry, caseous consistency and may be teased out in the form of minute branching cylinders.
- PLATES VI, VII, VIII.—Photomicrographs of hog cholera bacilli in different culture media. All were made at a uniform magnification of 1000 diameters, with the Zeiss apochromatic objective of 3^{mm} and 1.30 numerical aperture, using projection ocular No. 4 and Abbe condenser with largest diaphragm. Orthochromatic plates and picric acid screen.
- PLATE VI, FIG. 1.—Coverglass preparation from spleen of rabbit inoculated with hog cholera bacilli. Stained two to three minutes in aqueous solution of fuchsin. Mounted in xylol balsam. $\times 1000$.
- FIG. 2.—Coverglass preparation from bouillon-peptone culture five days' old. Stained in aniline-water-fuchsin for five minutes, and decolorized in one per cent. acetic acid for a few seconds. Mounted in xylol balsam. $\times 1000$.
- PLATE VII, FIG. 1.—Coverglass preparation from bouillon-peptone culture one day old. Stained same as Fig. 1 of Plate VI. Mounted in xylol balsam. $\times 1000$.
- FIG. 2.—Coverglass preparation from gelatine culture two days old. Stained same as Fig. 2, Plate VI. $\times 1000$.
- PLATE VIII, FIG. 1.—Coverglass preparation from colony of hog cholera bacilli taken from an Esmarch tube, made directly from spleen of pig, fifteen days old. Stained same as Fig. 1, Plate VII. $\times 1000$.
- FIG. 2.—Coverglass preparation of hog cholera bacilli from *agar* culture fifteen days old. Stained same as Fig. 1, Plate VI. $\times 1000$.



SWINE PLAGUE. (Right Lung + $\frac{2}{3}$)



SWINE PLAGUE. (Right Lung + $\frac{2}{3}$)



FIG.1.



FIG.2.

G. Marx, fecit.

SWINE PLAGUE.



FIG. 1.

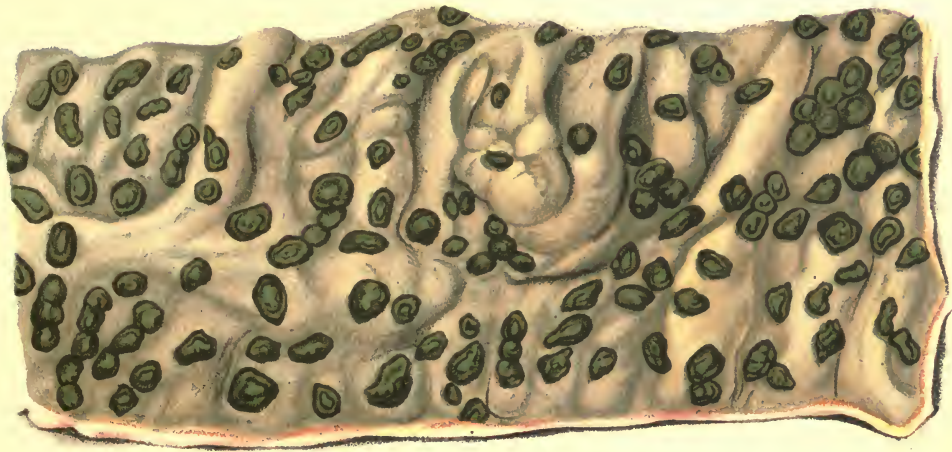


FIG. 2.

G. Marx, fecit.

SWINE PLAGUE.



Fig.1.



Fig.2.

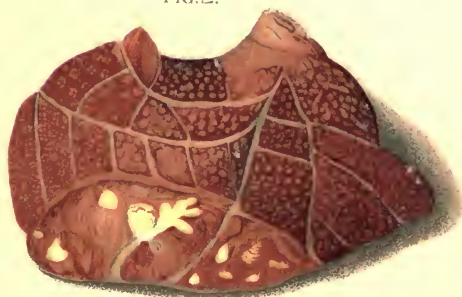


PLATE VI.
PHOTOMICROGRAPHS OF HOG CHOLERA BACILLUS.

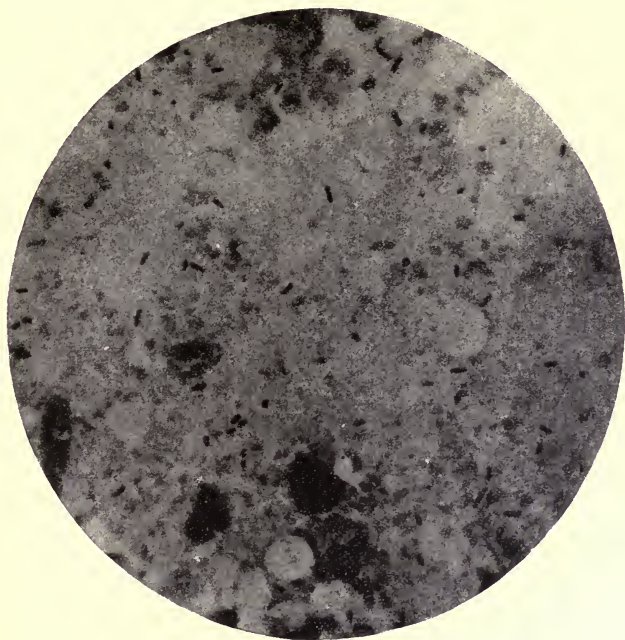


FIG. 1. X 1000.

COVERGLASS PREPARATION FROM SPLEEN OF INOCULATED RABBIT.

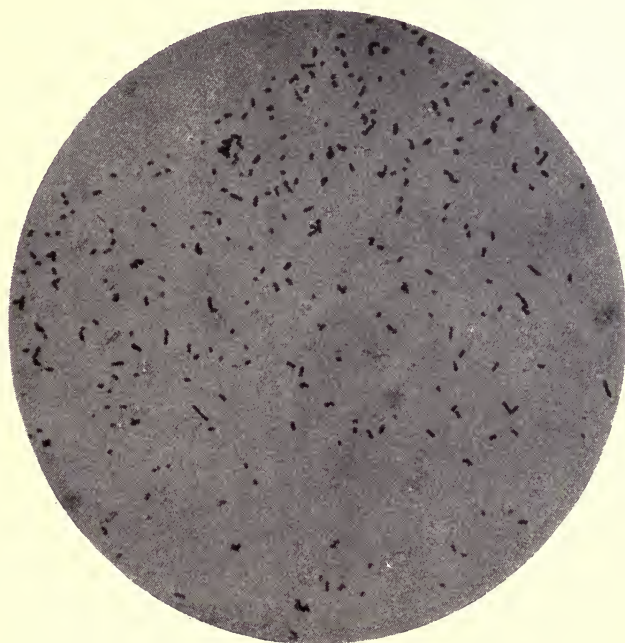


FIG. 2. X 1000.

COVERGLASS PREPARATION FROM LIQUID CULTURE FIVE DAYS OLD.

PLATE VII.
PHOTOMICROGRAPHS OF HOG CHOLERA BACILLUS.

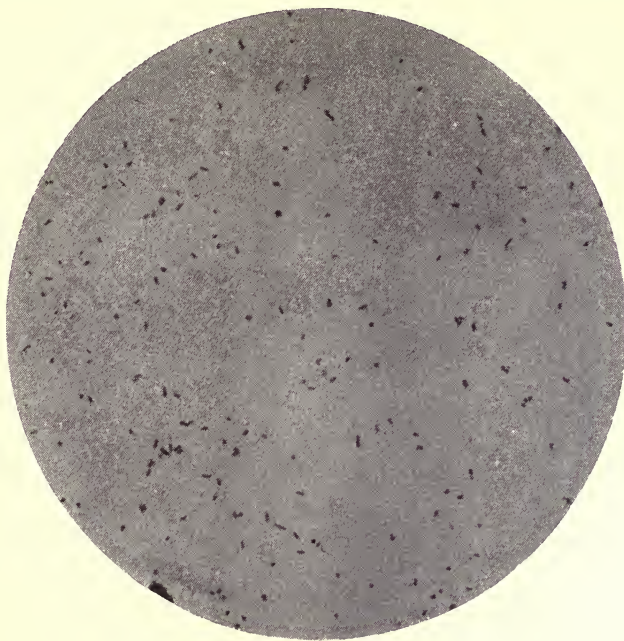


FIG. 1. X 1000.

COVERGLASS PREPARATION FROM LIQUID CULTURE ONE DAY OLD.

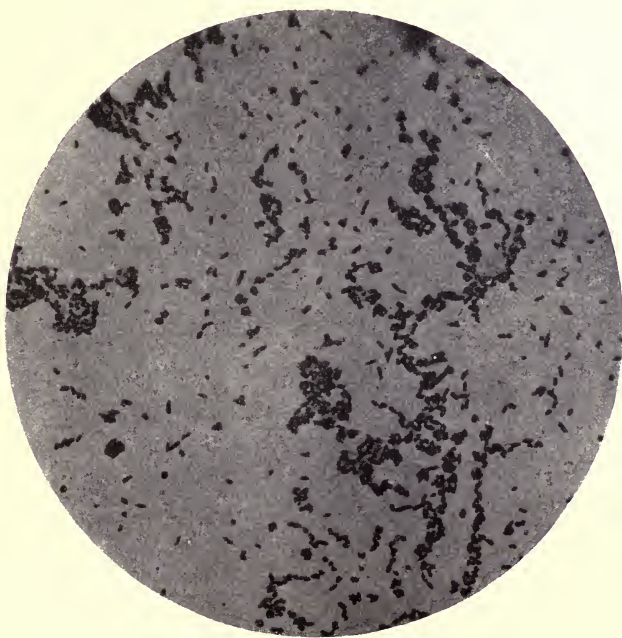


FIG. 2. X 1000.

COVERGLASS PREPARATION FROM GELATINE CULTURE TWO DAYS OLD.

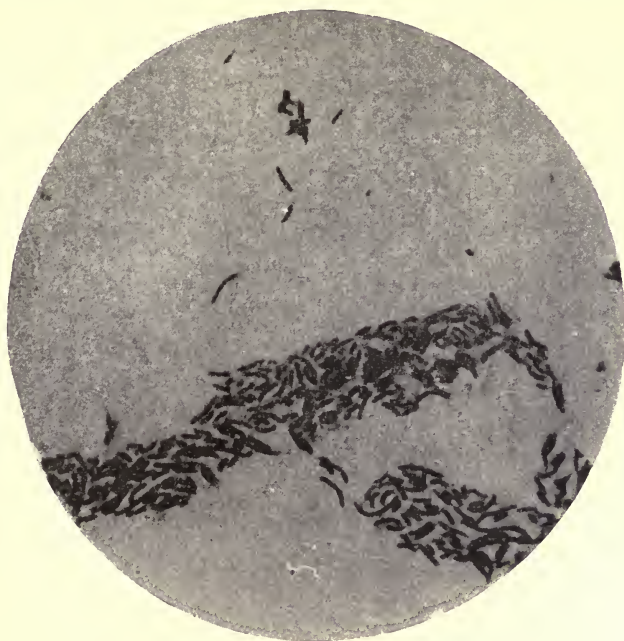


FIG. 1. X 1000.

COVERGLASS PREPARATION FROM ROLL CULTURE (ESMARCH TUBE)
FIFTEEN DAYS OLD.

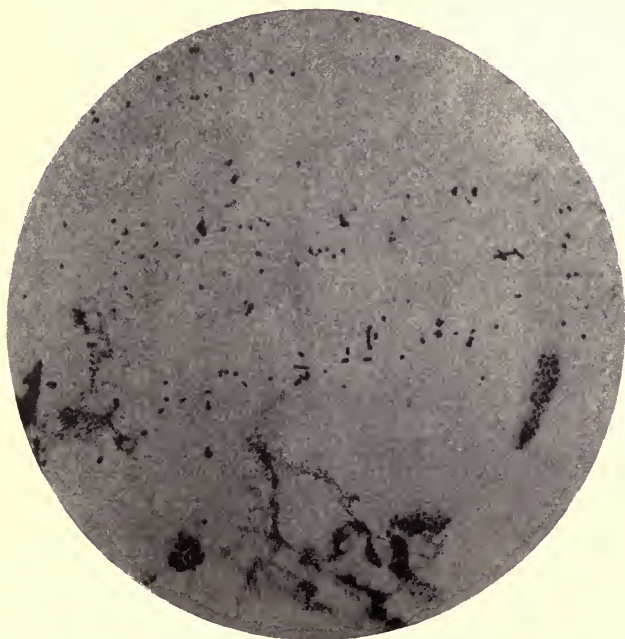


FIG. 2. X 1000.

COVERGLASS PREPARATION FROM AGAR CULTURE FIFTEEN DAYS OLD.

SWINE PLAGUE MICROCOCCUS.

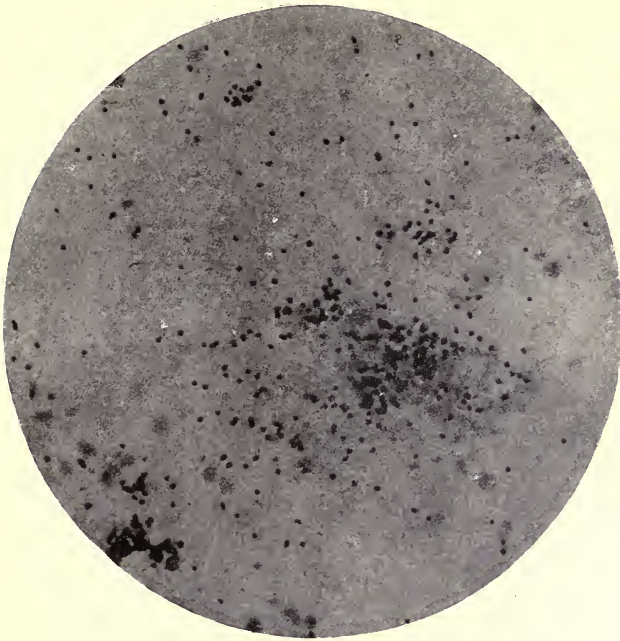


FIG. 1.

COVERGLASS PREPARATION FROM AGAR CULTURE.

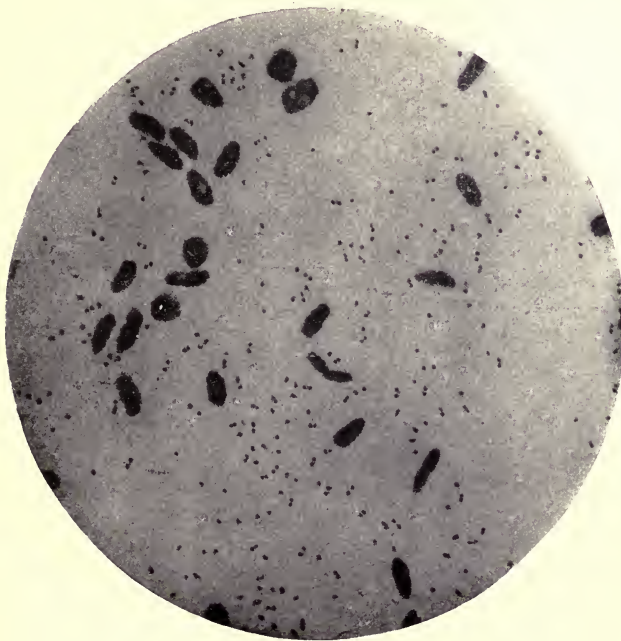


FIG. 2.

COVERGLASS PREPARATION FROM BLOOD OF INOCULATED PIGEON.

EXPERIMENTS ON THE ATTENUATION OF HOG CHOLERA BACILLI BY HEAT.

INVESTIGATIONS OF 1888.

Heat has been used by Pasteur in the attenuation of anthrax virus by exposing cultures of anthrax bacilli to a temperature of 42° – 43° C. continuously for a certain number of days. Cultures kept in a thermostat at this temperature for about thirty-one days were so attenuated that they were incapable of destroying animals larger than very young mice. Kept in the same conditions for only twelve days, inoculation failed to destroy adult guinea pigs.* The former culture was denominated the first, the latter the second vaccine. To make sheep immune they were inoculated subcutaneously with the first vaccine and twelve days later with the second vaccine. Subsequent inoculation with strong virus had no effect upon the vaccinated animals, although it was quite invariably fatal to those which had not been so treated.

Although Pasteur's discovery must be considered a scientific event of great importance, its practical application is by no means a perfect success. Experiments conducted by Koch, Gaffky, and Löffler, in Berlin, have shown that the process of attenuation does not always go on uniformly, and that the strength of the vaccine can not always be relied upon. A few animals may die as a result of the first or second inoculation. This fact induced the last international congress of hygiene at Vienna to adopt the resolution that anthrax vaccination should not be practiced upon sheep in any locality unless the disease causes a loss of 2 to 3 per cent. annually. It was also shown in the experiments at Berlin that immunity after vaccination is not absolutely perfect when the virus is introduced with the food. This is perhaps the most common way in which infection takes place.

The results obtained by Pasteur are sufficiently valuable to make it at least desirable to try heat attenuation for other bacterial organisms, although it does not follow by any means that the same process will suffice for all or even a small number of disease germs, for these differ among one another very widely.

Kitt† has tried heat in the attenuation of the virus of Black Quarter in Germany by exposing the diseased muscular tissue, which had been thoroughly dried in the air and ground to a fine powder, to the steam of boiling water at 100° C. for four, five, and six hours continuously. The spores of the bacilli of this disease were sufficiently attenuated after a six hours' exposure so that sheep inoculated with the powder in certain doses remained well after inoculation with strong virus. The reaction after the vaccinal inoculation was very slight. Hog cholera virus is destroyed by a fifteen to twenty minutes' exposure in a water bath at 58° C. A momentary contact with boiling water is sufficient to destroy it, so that Kitt's method is not applicable to it but only to bacteria which form spores.

The following experiments were undertaken with a view to test the method of Pasteur on hog cholera bacilli, and to obtain, if pos-

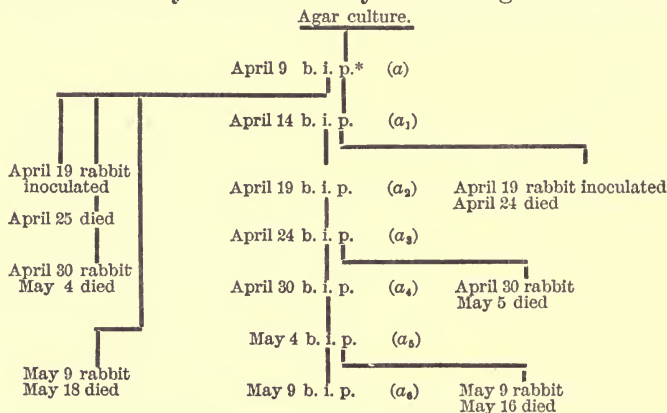
* *Compt. Rend. Acad. des Sciences*, March 21, 1881.

† *Centralbl. f. Bakteriologie u. Parasitenkunde*, 1888, i, 571.

sible, a vaccine similar to that employed in the prevention of anthrax. Although only a preliminary step has been taken in this matter, and the promise of favorable results is not flattering, we consider it best to publish the results thus far obtained.

The first step in the process was to obtain, if possible, a cultivation which should prove harmless to rabbits. This was to be accomplished by placing tubes in a thermostat kept at a certain fixed temperature as nearly as possible, and inoculating rabbits from time to time to determine any diminution in the pathogenic activity.

April 9, 1888.—Four Salmon tubes of beef-infusion peptone were inoculated from an *agar-agar* culture of hog cholera bacilli two weeks old, and placed in a d'Arsonval thermostat, the internal temperature of which registered between 42° and 43° C. Two series of inoculations were made on rabbits, one from one of the original liquid cultures at different intervals, the other from a culture renewed at the end of every five days by inoculating a fresh tube. The result is most easily understood by examining the following table:



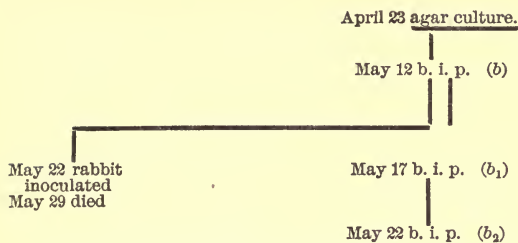
The first inoculations were made April 19, with culture *a*, which had been in the thermostat ten days, and culture *a*₁, which had been freshly made on April 14. Both rabbits received about $\frac{1}{2}$ cubic centimeter of the culture liquid hypodermically. Rabbit *a*₁ died in five days with extensive coagulation necrosis in liver and enlarged spleen. Rabbit *a* died on the following day with the same lesions. In both hog cholera bacilli were very numerous on cover glass preparations of spleen, and obtained pure in cultures. The same results were obtained in all subsequent cases so that no further mention need be made of this.

Two rabbits were inoculated in the same way April 30, one from the original culture *a*, the other from *a*₃. Both died May 4 and 5, respectively. Lesions the same as with the first pair.

Two rabbits were inoculated May 9, one from the culture *a*, now thirty days old, the other from *a*₆, the fifth renewal of *a*. Both rabbits died on the 7th and the 9th day, respectively. The lesions were practically the same, with the addition of slight hemorrhagic lesions in the intestinal tract. The period of the disease was slightly prolonged.

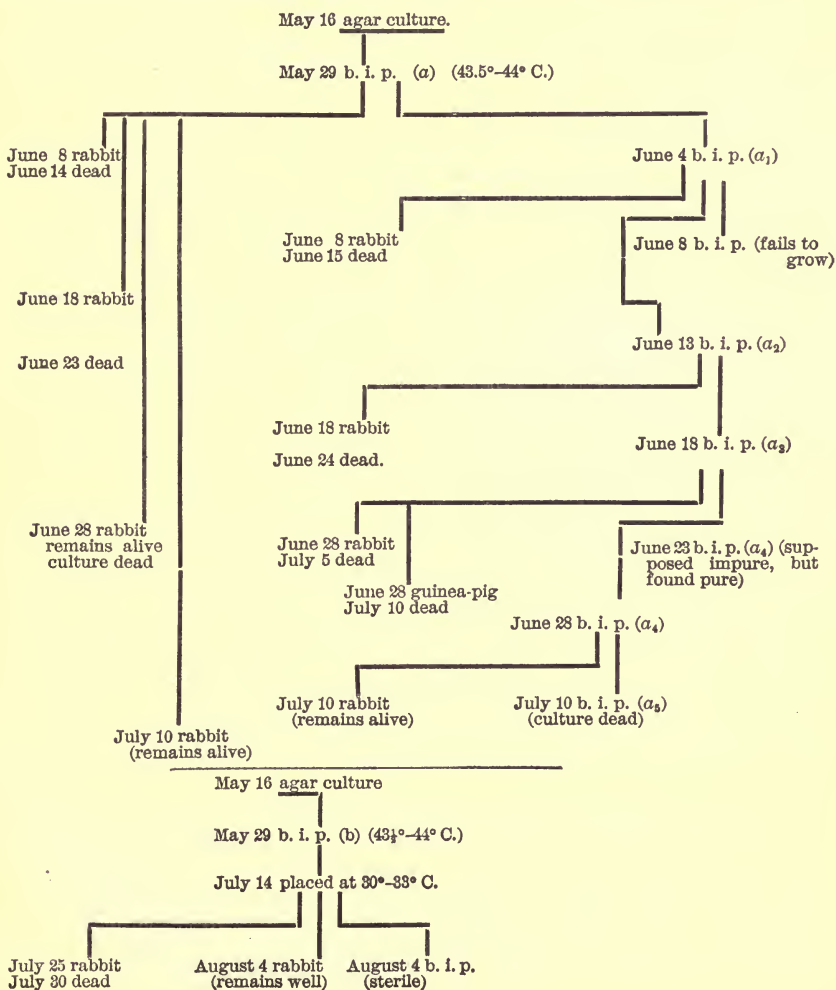
The result was not very satisfactory, therefore, for if any attenuation was going on its final attainment would demand too long a period of time. The experiment was therefore stopped and another undertaken. The temperature of the thermostat was raised to 45° C. to hasten the process of attenuation.

* Beef infusion plus 1 per cent. peptone.



It was found that cultures inoculated from *b* failed to develop at the assigned temperature, so that this experiment was not continued any farther. It deserves to be mentioned, however, that a rabbit inoculated from the original culture which had been kept at 45° C. for ten days died seven days after inoculation with enlarged spleen and coagulation necrosis in liver.

A temperature of 43½°–44° C. was next chosen, and the experiment conducted in the same manner, as the appended table will show :



The rabbits inoculated from the original culture, after remaining at the temperature of 43.5°–44° C. for ten and twenty days, died from the inoculation disease, but those inoculated from the same tube after thirty and forty-three days remained permanently well. This was not due to an attenuation of the culture but to its death. Turning to the series of rabbits inoculated from the cultures renewed every five or ten days, those receiving culture liquid ten, twenty, and thirty days old died from the inoculation disease, while one inoculated after forty-three days remained alive, because the culture was dead, *i. e.*, it failed to fertilize fresh tubes after repeated inoculation. An adult guinea-pig, inoculated from the same culture material thirty days old, died in 12 days as a result of the infection. In this case only a few drops had been injected. This experiment demonstrates that in general the pathogenic power of hog cholera bacilli is only destroyed by the death of the organisms themselves. This is a very important fact. It will be remembered that in the attenuation of anthrax bacilli, their virulence was gradually diminished and a time was reached when they failed to kill all but mice, while they still retained the power of multiplying in nutritive liquids. In the above experiments even guinea-pigs, which are less susceptible to this disease than rabbits, died twelve days before the culture was found dead. The latter may have been dead some days before this, for no tests were made meanwhile.

This fact has an important bearing upon the nature of the pathogenic activity of hog cholera bacilli. It shows that there are two elements involved, (1) the ptomaine action of the organism; (2) their mechanical effect. That there is a ptomaine action of these bacilli has been conclusively proved in the experiments of the Bureau made upon pigeons several years ago. But this ptomaine action is evidently secondary to the mechanical effect of the bacilli in forming plugs or thrombi in the blood vessels and thus causing destruction of tissue by impeding the circulation. This tendency to act mechanically is not lost as long as the bacilli are alive, as shown by their fatal effect on rabbits and guinea-pigs shortly before they themselves are destroyed.

At the temperature employed (43.5°–44° C.) the original bouillon-peptone culture *a* died between the twentieth and the thirtieth day after the beginning of the exposure. The culture from this, renewed at the end of every fifth or tenth day, died between the thirtieth and forty-second days. Another culture, *b* (see table), which had been removed from the thermostat after the forty-sixth day and kept at the temperature of the laboratory (about 30°–33° C. during July), was still fatal to a rabbit on the fifty-seventh day. Another rabbit inoculated ten days later remained well, and a fresh culture made at the same time remained sterile, showing that the apparent immunity of the rabbit was due to the death of the bacilli injected. This experiment also shows pretty conclusively that the pathogenic power of these specific organisms expires only with their life and not long before.

It is evident from our own experiments and more recent ones made in France and Germany, and conducted on the same lines, that the amount of immunity which we may expect to gain from preventive inoculation will depend on the quantity of ptomaines produced by the specific microbes, *i. e.*, upon their poisonous nature. In other words, our success will depend upon the relation borne by the ptomaine to the disease process. If this factor is very great it is highly

probable that preventive inoculation either with ptomaines or with attenuated cultures will be successful. But if there is, in addition, a mechanical element which may overshadow in importance the ptomaine element, the problem is not only complicated, but may fail.

There are two other points in connection with these experiments which demand attention. One is the variation in the length of life of the different cultures exposed to the same conditions. This would be a serious hindrance in obtaining vaccinal cultures of uniform strength should this method ever prove successful.

There was a noticeable change in the appearance of the serial cultures after a sojourn in the thermostat. There was a tendency to multiply rather more abundantly, to grow in minute flakes, and to rise to the surface to form a thin, unbroken membrane. The motility was somewhat impaired after a time. These changes gave rise to the suspicion of impurities, but tests on gelatine plates showed that the suspicion was unfounded. These experiments will be continued on rabbits and pigs under similar conditions to determine whether any immunity can be produced by this method.

INVESTIGATIONS OF AN OUTBREAK OF INFECTIOUS SWINE DISEASES NEAR BALTIMORE, MD., SEPTEMBER, 1888.

The practical difficulties in connection with the solution of the problem of infectious swine diseases has been pointed out, in the annual report of the Department of Agriculture for 1887, to be due to the existence of two diseases producing lesions of the intestinal tract which shade into one another and are therefore not distinguishable by the naked eye. The presence of the specific microbe seems to be the only final test. As a rule, however, swine plague is primarily a disease of the lungs, secondarily of the digestive tract, while we have invariably found hog cholera a disease of the intestinal tract and more particularly of the large intestine, with unimportant lesions of the lungs very likely not due directly to the hog cholera virus. This difference may often serve as a guide when bacteriological examination can not be made, but even this is frequently misleading. The existence of extensive lung disease as the result of the polar-stained swine plague organism does not exclude the simultaneous existence of hog cholera. It is not an uncommon thing to find the lesions of both diseases as well as the microbes which produce them in the same animal. The following cases illustrate this condition of things very well. Several pigs from two separate herds near the city of Baltimore, Md., which were affected with some infectious malady were examined and both hog cholera and swine plague germs were found in the same animal. One of these animals was transferred to the experimental station at Washington, and there gave rise to an epizootic of both diseases. The swine plague soon gave way to the hog cholera, however, and later on lung disease was but a secondary element in the disease, hog cholera persisting with variable severity for months after.

In the herd which contained the following pigs the disease broke out four weeks ago and was very likely due to the introduction of infected swine by purchase.

September 10, 1888.—A small shoat (No. 1) from this herd was seemingly very ill. Flanks tucked in, hind portion of body swaying and tottering when the animal moved. It was killed by cutting its throat.

In the lungs was found broncho-pneumonia, localized chiefly in the ventral and cephalic lobes. In the larger bronchi lung worms were present. Superficial inguinal as well as the mesenteric glands were swollen and slightly congested. The spleen was but moderately enlarged. In the upper portion of colon were two small superficial ulcers. The mucosa was otherwise intact as far as the rectum. In the latter situation it was covered with a peculiar grayish deposit, soft, almost like lard, without tenacity. It was arranged as isolated round patches, from one-eighth to one-fourth inch across and about one-sixteenth inch thick; the mucous membrane for a distance of 18 inches from the anus being thickly covered with them. They are easily removed and leave a slight depression in the mucosa without apparently any loss of substance. This exudate is made up of degenerated cells, probably epithelial in origin, but they are too far broken down to allow any closer examination. Immense numbers of bacteria in this deposit of two kinds chiefly; a rather large oval bacillus, with periphery more deeply stained and a very slender rod.

From this exudate a rabbit was inoculated (September 11) by stirring it up in sterile water thoroughly and injecting some of the liquid under the skin of one thigh. The rabbit was dead on the sixth day. There was an extensive sanguinolent staining of the subcutis of the entire abdomen, and of a part of the thorax and thighs. Groups of petechiæ on the cæcum. Some of the coils of intestine lightly glued to abdominal wall. Spleen small. The peritoneal surface is covered with minute cocci; the same are present in the blood. *Agar* cultures from the peritoneal surface and heart's blood contained the same organisms. Although polar staining was not manifest, there was no doubt that the microbe was the non-motile swine plague germ.

At the same time a rabbit was inoculated in the same way with lung tissue. This animal died in two days. The subcutis of inoculated thigh slightly blood-stained. The superficial muscular fiber of a grayish homogeneous appearance. The fascia and muscles of the contiguous portion of the abdominal wall opaque, infiltrated. On the coils of intestine a few small masses of a whitish exudate. Spleen slightly enlarged; liver very much engorged. No bacteria could be distinctly seen on cover-glass preparations from liver, spleen, and blood. But tubes inoculated from blood and spleen contained on the following day only swine plague germs. Roll cultures made from the lung tissue of the pig were liquefied completely in a few days.

The examination of the spleen gave quite different results. Although the microscope did not reveal any bacteria on one cover-glass preparation from the spleen, three liquid cultures into which a bit of spleen had been placed contained on the following day actively moving hog cholera bacilli. On the surface of an *agar* culture a considerable number of colonies of the same organism made their appearance. A roll culture made from one of the liquid cultures contained about 300 colonies, non-liquefying, all alike, and resembling in growth hog cholera bacilli.

It was very important to determine the pathogenic character of this bacillus in order to confirm the diagnosis based upon its appearance under the microscope and in cultures.

September 13.—Two mice were inoculated subcutaneously, each with several drops from one of the liquid cultures from which the roll culture had been made. One mouse was dead September 19, with spleen

enlarged, and in it numerous hog cholera bacilli; the second mouse remained apparently well and was killed fifteen days later. Its spleen was enormously enlarged, and it would no doubt have succumbed in a few days. But the following intravenous injection from an agar culture which was inoculated from the original spleen agar culture is sufficient to set aside all doubt as to the nature of the spleen bacilli:

November 12, 1888.—Pig No. 90, black and white, about five months old. The right crural vein was exposed by raising a triangular flap of skin over it after thoroughly disinfecting the latter with a 1:500 solution of mercuric chloride. Five cubic centimeters of a beef-infusion peptone culture inoculated from an agar culture about a week old was injected into the exposed vein with a hypodermic syringe thoroughly disinfected with 5 per cent. carbolic acid. The liquid culture was two days old when used. Two hours after the inoculation the temperature had risen from 103½° F. to 107° F. November 13, there was no swelling, but a slight serous oozing at the place of inoculation. The appetite was good. November 14, at 3 p. m., the temperature was 107½°. The animal was disinclined to move, although it came to eat in the morning and evening. November 15, it lay on its side, quietly, with occasional kicking. Found dead at 4 p. m. Autopsy held immediately.

General blush on skin of ventral aspect, snout, and lips. No swelling at the point of inoculation; slight blood extravasation. Spleen enormously enlarged, 14 inches long, two-thirds inch wide, and one-half to 1 inch thick, gorged with dark blood, and friable. Superficial inguinals enlarged, oedematous; on section diffuse pale red spots; cortex congested. Bronchial and renal glands enlarged, partly hemorrhagic; gastric glands hemorrhagic throughout substance. The blood is thick, dark colored, coagulation slight, even after several hours' exposure to the air. Several petecchiæ on epicardium of right auricle. Right side of heart distended with blood. In it a small white clot. Left heart contracted, empty. Lungs normal, excepting one-third of left ventral lobe, which is collapsed. Kidneys enlarged, deeply congested throughout. The surface is thickly dotted with minute deep red points. The papillæ so deeply reddened that any extravasations would not be recognizable. A few petecchiæ in pelvis. Bladder contains about 30 grams of urine tinged with blood. The whole mucosa of stomach is deeply congested. In fundus it is hemorrhagic, with numerous patches of necrosed epithelium one-quarter to one-half inch across. The upper 8 inches of duodenum in the same condition as the fundus of stomach. Numerous red points scattered over mucosa of entire small intestine. In lower ileum a few hemorrhagic points. The mucosa of cæcum and upper colon very slightly congested, but the remaining two-thirds intensely so. Hemorrhage here and there sufficient to stain the feces with blood which were otherwise normal. The mesenteric and meso-colic glands all deeply congested throughout their substance.

Cover-glass preparations from spleen pulp showed a large number of hog cholera bacteria. Cultures from the same revealed the presence of the same organisms only.

September 19.—Pig No. 2, alive in the morning, dead at noon. Examined soon after death. Slight reddening of skin on throat, inside of limbs and pubic region. Spleen very large, engorged, softened. Lymphatic glands generally enlarged but pale, excepting the retroperitoneal glands, the cortex of which is deeply congested. Liver imparts a harsh sensation to the knife. Kidneys normal. *Echinorhynchi* in jejunum attached to ulcerous depressions in the mucosa. Lowest 12 inches of ileum contain several deep ulcers one-fourth to three-fourths inch across. The mucosa of the ileo-cæcal valve is thickened, ulcerated superficially, and indurated beneath. There are several large ulcers near the valve and in the upper colon, from one-half to 1½ inches across. The corresponding serosa inflamed and attached to neighboring organs.

All but the caudal and dorsal half of the principal lobe of each lung solidified. The diseased principal lobe has a bluish-red, the other lobes a pale grayish-red color. In the former the infiltration is in the form of minute whitish plugs in a red ground. The latter

on section has a glistening, half-gelatinous aspect. The cut bronchioles exude a milky, purulent fluid.

Bacteriological examination of lungs showed in stained cover-glass preparations a large number of pus cells and polar-stained bacteria, located chiefly around the nuclei of the larger cells and probably embedded in the now disintegrated cell protoplasm. A few large bacteria present. Of two roll cultures from this grayish lung tissue one was completely liquefied, the other partially so. A rabbit inoculated from the same tissue (grayish) died in four days.

The fascia of the inoculated thigh was much thickened, whitish, the subjacent muscular tissue discolored, pale. Intense peritonitis manifested by a grayish exudate covering large intestine and liver; the serosa of the former was extensively ecchymosed and glued to the ventral abdominal wall. The exudate consisted chiefly of leucocytes and immense numbers of polar-stained swine plague bacteria. These were very scarce in blood. An *agar* culture from the latter contained only swine plague bacteria. A rabbit inoculated at the same time with the red hepatized tissue was ill subsequently, but recovered. It was killed on the sixteenth day. An extensive subcutaneous abscess was found over the abdomen, with necrosis of the skin, which was converted into a dried mass hard as a board. Spleen very slightly enlarged.

From a bit of spleen pulp from the pig, which was engorged, dark, and enlarged, a roll culture was made. About one hundred colonies of hog cholera bacilli developed. Two beef-infusion peptone tubes into which spleen bits were placed contained on the following day hog cholera and butyric bacilli. To test the virulence of the hog cholera bacilli, two or three drops of one liquid culture were injected beneath the skin of two mice September 28. One died prematurely on the following day with enlarged spleen, owing to the extensive invasion of liver and kidneys with coccidia, and consequent degeneration of these organs. The second mouse died in three days with a large number of *taenia* in the dilated duodenum. Both died no doubt from the inoculation, but their death was hastened by the presence of the parasites, making the demonstration unsatisfactory.

Another pig (No. 3) which had been found dead in the morning and undergone considerable decomposition was examined superficially at the same time. The spleen was very much enlarged; lungs normal. The large intestine contained extensive ulcers with localized peritonitis and adhesion to surrounding structures. No bacteriological examination was made.

A third pig from the same herd (No. 19) was taken, while sick, to the Experiment Station of the Bureau in order that fresh pigs might be infected and our study of the disease continued. It was found dead September 24, four days after its arrival. This animal also manifested both diseases, more prominently so than those already described. Both germs were found in its body, the hog cholera bacillus in the spleen, the swine plague coccus in the lungs, as the following notes show:

Autopsy several hours after death. No skin discoloration. Spleen very large, due to blood engorgement. Lymphatic glands of abdomen in general very much enlarged, and slightly congested, excepting those of mesentery. Kidneys normal. Liver slightly cirrhotic, somewhat gritty on section. Mucosa of empty stomach covered with yellow bile-stained mucus. Small intestine not diseased. In the cæcum and upper 12 inches of colon, about a dozen ulcers, one-half to 1½ inches across, with a dirty blackish floor. The ulceration has produced inflammation of the serosa and thickening of the wall.

Lungs extensively diseased. Of the right, the caudal half of the cephalic, the entire ventral, and the cephalic (anterior) third of the principal lobe hepatized. Of the left lung the same regions, including the azygos lobe, are in the same condition.

Over these diseased lobes the pleura is covered with a translucent, very thin exudate, either in the form of dots or a mesh-work. Only a little of the adjacent normal lung tissue has the pleura roughened. The exudate is made up of leucocytes and a large number of slender bacilli. The diseased lung tissue, from the surface, is red, mottled with minute grayish dots; this mottling is faint in some regions, in others the dots seem to coalesce into grayish patches. The cut surface is grayish red. When compressed, whitish, semi-solid plugs are forced out of the air tubes. In some places these are replaced by a milky, flaky fluid. They consist of leucocytes and epithelium with very few bacteria. No polar-stained bacteria observed. The bronchial and tracheal glands very large, tough, pale pink on section. The trachea and bronchi coated with bright red foam. In the ends of the latter some lung worms.

Pericarditis probably an extension of the pleuritis. Both sides of heart and large vessels contain white thrombi.

A roll culture in gelatine from lung tissue developed a few fungi only.* A rabbit inoculated with lung tissue died in four days. The subcutis of the inoculated thigh much thickened with infiltrated cells (suppuration); over the abdomen also thickened and blood-stained. The cæcum studded with hemorrhagic points and covered with a gelatinous exudate, which is also found on liver. A cover-glass touched to this exudate contains immense numbers of polar-stained bacteria; very few in blood and spleen. *Agar* cultures from these develop in moderate number colonies of swine plague bacteria.

From bits of spleen pulp of the pig an *agar* culture, a gelatine roll culture, and a liquid culture were made. The *agar* and the liquid culture contained the motile hog cholera bacilli; the latter also spore-bearing butyric bacilli. The roll contained but two colonies. Of two mice inoculated from the liquid culture one died on the following day; the other in five days, with enlarged spleen, containing hog cholera bacilli in considerable numbers, which were also obtained pure in an *agar* culture. This mouse had its liver and kidneys thoroughly infested with coccidia.

At the same time a pig from another herd near Baltimore was examined. The owner had purchased ten young pigs in May. They began to cough and gradually emaciate about one month ago; since then five had died. One of the survivors, emaciated, very weak, with arched back, "tucked-up" abdomen, and dull, sunken eyes, was killed for examination.

The spleen was not enlarged. The lymphatics in general were enlarged, pale, and firm. Lungs normal, with exception of two or three collapsed areas from one-half to three-fourths of an inch across. Liver and kidneys normal. Catarrhal condition of stomach. In the jejunum a number of ulcers, to two of which *echinorhynchi* are attached. These worms are very likely the cause of the ulcers. In the cæcum and upper colon, especially on and around the valve, were about twenty ulcers, one-half inch across. The slough fell out of most of them while the specimens were being carried from Baltimore to Washington. The ulcers deprived of the slough are nearly circular; the base formed by the muscular wall; the sides vertical, as if the mucosa had been punched out, the border being slightly thickened. The slough itself was yellowish, crumbling. A rabbit inoculated with some of it stirred in sterile water dies in twenty-four hours with slight peritonitis, internal organs generally congested and containing numerous oval swine plague bacteria. A liquid culture from the heart contained only swine plague bacteria, while a gelatine tube culture from the spleen failed to develop.

From the spleen two tubes of nutrient liquid contain a motile bacillus not distinguishable from hog cholera bacilli. A gelatine roll culture contains about six colonies of the same organism.

To test the pathogenic power of this bacillus two mice were inoculated from the liquid culture. One died on the following day, with numerous hog cholera bacilli in spleen and liver. Premature death, due to extensive degeneration of these two organs, which was caused by coccidia. The second mouse died on the seventh day, with enlarged spleen and extensive coagulation-necrosis in liver. Both organs contain numerous hog cholera bacilli. An *agar* culture from the spleen confirmed the microscopic diagnosis.

We have thus four cases in which both hog cholera and swine plague bacteria are present according to the unequivocal results of bacteriological examination. The same was observed in the out-

* This swine plague germ did not, as a rule, grow in gelatine at the ordinary temperature of the room.

break of swine plague which occurred in the beginning of 1887, and which is reported in the preceding pages. In that outbreak the earlier cases examined revealed only swine plague bacteria. Later on both hog cholera and swine plague germs were encountered in the same animal in a certain number of cases. Finally the swine plague died out towards spring and only the hog cholera remained, causing even at that time some very acute cases. The swine plague was the original disease, the hog cholera being grafted upon it when the swine plague pigs from a neighboring farm were placed in pens infected with hog cholera at the station. Even as early as September, 1886, some investigations in Illinois brought out the then remarkable and puzzling fact of two disease germs found in the same animal at the same time.

Before describing the outbreak caused by the pig brought from Baltimore to the Experiment Station, it will be necessary to briefly indicate the condition of things at the latter in order to explain some of the occurrences which followed.

In the beginning of the present year a series of experiments were planned to vaccinate pigs with sterilized cultures of hog cholera bacilli. Experiments of this character are reported as having been begun in the Annual Report of the Bureau of Animal Industry for the year 1886, p. 50. These were not successful on pigs at that time, and it was thought best to inject the sterilized culture liquid in large quantities directly into the peritoneal cavity. Without going into detail, suffice it to say that about twelve pigs were vaccinated in this way, three receiving 800 cubic centimeters in doses of 100 cubic centimeters at intervals of about one week, three 600 cubic centimeters, three 400 cubic centimeters, and three 200 cubic centimeters.

The experiment, including all inoculations, lasted from February 15 to the beginning of April. Owing to some accident or error in the sterilization of the culture liquid this sterilization was not completed in some of the liquid used, although a number of precautions had been taken to insure absolute sterility, which need not be recounted here. One of the animals died of acute hog cholera on the day following one of the inoculations. Its mate died within fourteen days after the same inoculation of hog cholera. Another died within twenty-four hours after one of the injections because of some injury to the intestines during the injection. As these pigs were distributed in groups of three in different pens, it was thought that the accident of using incompletely sterilized cultures was limited to one pen, but subsequent events showed this supposition to be untrue.

The remaining pigs, ten in number, were carefully watched for nearly two months (until May 25), and then brought together into one pen to await a favorable opportunity for exposure to hog cholera. There were in this lot Nos. 482, 483, 484, 490, 491, 493, and Nos. 8, 9, 11, and 12. There were also added Nos. 5, 6, 13, and 15, as control animals. Of these animals, No. 482 died June 13, very much emaciated and with extensive ulceration in the large intestine. No. 493 died July 5, of peritonitis, indirectly due to extensive ulceration of the large intestine. The animal had shown previous to its death no indications of illness. No. 484 died July 15, also of hog cholera. The lesions of this case will serve as an illustration of the others.

Spleen not enlarged. Considerable recent adhesions among coils of large intestine. The mucosa of large intestine contains ulcers as large as silver dollars, with a blackish, irregularly gnawed floor. They only involve the mucosa. About the middle of colon a tumor is situated in the muscular coat of the intestinal wall as large as a

horse-chestnut. The contents are whitish, of a putty-like consistency. Attached to the spleen by means of tough, fibrous tissue, evidently part of the omentum, is a cylindrical encysted mass of the same consistency, 3 to 4 inches long and one-half inch wide. These masses represent without doubt the place where the incompletely sterilized culture liquid was deposited by the needle.

In the thorax the ventral lobes of both lungs are enlarged, airless, of a pale reddish, translucent, gelatinous aspect. The bronchi of these lobes are filled with a glairy muco-pus and contain some lung worms. Two rabbits inoculated from an emulsion of lung tissue both died of hog cholera on the eighth and ninth day.

No. 482, found dead September 16, had several old ulcers in the large intestine. The lungs were extensively adherent to the chest wall by old fibrous bands, and in part airless and of a pale red color.

When the Baltimore pig was brought to the station there was what may be considered chronic hog cholera, but no evidence of swine plague as shown by the inoculation of lung tissue from No. 484 into rabbits some time ago, and also the autopsies of the pigs which had died meanwhile. The ulcers were probably directly due to the intra-abdominal injection of the culture liquid supposed to be sterile, and death was brought on chiefly through peritonitis as the result of the ulceration. If the disease, so chronic in character as to elude detection and to last from three to six months, was still capable of infecting other animals it did not do so, as not only four of the vaccinated pigs but also the four control animals were still alive and apparently well.

Soon after the arrival of the sick Baltimore pig it was penned with these survivors, and fresh pigs were put in the infected pen as the inmates died. Thereupon pigs died quite rapidly, with lesions indicating the presence of swine plague and a decided renewal of hog cholera of a virulent type. Vaccinated pigs died very soon after in quick succession, some with marked swine plague lesions. A perusal of the autopsy notes given below will show that they all suffered from old ulceration, except No. 12, which died from injuries received. It also appears from the lesions that some of the pigs were very likely infected a second time. As the state of things was very complicated nothing positive can be said as to this point. The notes are simply given to aid in elucidating the subject of swine plague. As to two of the control animals which also died (Nos. 13 and 15), it would be very difficult to state from the autopsy notes whether they had been infected from the inoculated animals before September 20 or had contracted the disease from the Baltimore case. Nos. 5 and 6, the other control animals, died of hog cholera contracted evidently after the arrival of the Baltimore pigs, as the notes will show.

The introduction of the Baltimore pig was followed September 31, eleven days later, by the death of four pigs, Nos. 5, 8, 9, and 11.

September 31.—No. 5, control animal,* found dead this morning. Skin of ventral surface of body reddened; spleen enormously enlarged and congested. Hemorrhagic foci in lungs, but no hepatization. Large intestine deeply reddened and slightly ulcerated. Numerous hog cholera bacilli in spleen.

Pig No. 8, vaccinated animal, found dead this morning. Skin and spleen normal. Inguinal glands enlarged, oedematous, reddened. Liver cirrhotic. Kidneys with medulla congested. Stomach empty, mucosa bile-stained. In ileum several ulcers near valve. Mucosa of cæcum and upper third of colon almost entirely ulcerated; farther down ulcers isolated one-quarter to 1 inch across. Rectum intact. Lungs about twice the usual size of collapsed lungs; over both a pleuritic deposit appearing, either as a mesh-work or as minute dots, which give the pleura a roughened aspect, or as a continuous membrane, according to the quantity of exudate. Slight agglutination of lobes to chest walls and to one another. In each pleural sac about a teaspoonful of loose, soft exudate.

* These terms refer to the vaccination experiment.

The parenchyma of the hepatized regions is in general red, granular on section, with much reddish serum flowing from the cut surface, but the ventral and cephalic lobes are in more advanced stages, some parts being grayish red on section, others containing small foci of a peculiar pale, grayish-yellow color, with outline sharp and sinuous. These are, no doubt, necrotic masses, or sequestra. They are found in the cephalic lobe of the right lung. The same lobe of the left side is in a state of advanced broncho-pneumonia, the smaller air tubes being filled with a glairy muco-pus. The right principal lobe contains also centers of beginning necrosis. In the bronchial and tracheal glands, which are much enlarged, the cut surface shows grayish scalloped lines in a deeply congested ground. Trachea contains reddish foam. The bronchi contain cylindrical clots of dark and pale color embedded in mucus; in the smaller bronchi a frothy, thin, red liquid. The immediate cause of death, pulmonary hemorrhage.

Cover-glass preparations from lung tissue show large numbers of polar-stained swine plague bacteria. A rabbit inoculated therefrom died in eight days. The subcutis on the inoculated thigh and contiguous abdominal wall was thickened, pasty, and skirting this a blood-stained, gelatinous exudate. Peritonitis shown by the extensive ecchymosis of the cæcum and a grayish, gelatinous exudate covering spleen, liver, and a small portion of the intestine with a layer of variable thickness. This exudate is made up in part of pus corpuscles and great numbers of polar-stained bacteria. These are also abundant in the subcutaneous infiltrate, but rare in heart's blood. An *agar* culture from the peritoneal exudate contained on the following day a very thin, veil-like growth of swine plague bacteria.

In the barely enlarged spleen of the pig, hog cholera bacilli can be detected on cover-glass preparations. A roll culture and an *agar* culture contain the same bacilli only.

Pig No. 9, eight months old, vaccinated animal. Before this animal was placed in the infected pen it was fed portions of the spleen and large intestine of one of the Baltimore cases on September 20.

Skin normal; spleen barely enlarged. Cirrhosis of liver advanced. Kidneys with medullary portion deeply reddened. Lymphatics of meso-colon and near kidneys enlarged and congested. Stomach contains only a small quantity of bile-stained liquid. Duodenum extensively pigmented. Mucosa of cæcum and upper colon almost entirely destroyed, blackish. Below the middle of the colon the ulcers are isolated. The walls thickened and serosa inflamed where ulcers occur.

Lungs diseased; considerable serum in the right pleural sac. The whole of the right lung and the cephalic half of the left hepatized and covered with a pleuritic exudate similar to that in the preceding case. The principal lobe of the right lung is in a state of red hepatization, while the ventral lobe is farther advanced and contains the necrotic foci described under No. 8. The cephalic, ventral, and a portion of the principal lobe of the left lung in the same condition as the corresponding lobes of right side. Bronchial glands enlarged, with reddened cortex. Bronchi filled each with a dark, cylindrical clot. From the red hepatized regions cover-glass preparations show polar-stained bacteria in groups. The polar stain could only be made out clearly when the germs were magnified 1,000 diameters. Roll cultures from the lung tissue were useless, owing to the large number of liquefying germs present. A rabbit inoculated by injecting $\frac{1}{2}$ cubic centimeter of sterile water in which a bit of lung tissue had been torn up died in three days with a pasty infiltration of the subcutis of thigh and abdomen, slightly blood-stained; in one groin the subcutis very emphysematous. Liver and kidneys congested; spleen scarcely enlarged. Peritoneum of cæcum roughened; extravasations in meso-rectum. Immense numbers of polar-stained bacteria in subcutis as well as on inflamed peritoneum. Very few in spleen and blood. Two *agar* tubes from blood and spleen contained an abundant growth of the same germs next day. A gelatine roll culture from the blood remained sterile.

From the pig's spleen an *agar* culture contained only hog cholera bacilli. In a roll culture from a bit of spleen tissue about 200 colonies of the same germ and one producing liquefaction.

Pig No. 11, vaccinated, about eight months old; found dead this morning. Skin normal; spleen not enlarged. Lymphatics of large intestine (meso-colon) enlarged and deeply reddened; glands in other regions of the body enlarged, pale. Liver cirrhotic. Kidneys not changed. Stomach empty; mucosa bile-stained, along fundus highly congested. Large patches of superficial ulceration in lower jejunum and ileum. In cæcum and upper colon the mucosa is almost completely destroyed, and the surface appears as if charcoal dust had been rubbed into it. Walls much thickened. Very curiously a large diverticulum near the valve, forming a pouch, has its mucosa intact. Ulceration gradually disappears near rectum.

The lungs are also implicated, but there is no pleuritis. In all lobes are masses of

hepatized tissue varying in size, the largest probably $1\frac{1}{2}$ inches in diameter. The hepatization is chiefly of the grayish variety, the tissue being very hard to the touch. Some of these masses contain necrotic foci. The cephalic lobes are replaced by masses of collapsed tissue interspersed with emphysematous tissue. Bronchial glands very large, pale whitish on section. In each bronchus a thin, cylindrical, dark clot embedded in much glairy mucus. Lung worms in the blind end of both. Cover-glass preparations stained in gentian violet show leucocytes chiefly, with many polar-stained cocci located around the nuclei and very likely embedded in the cell protoplasm.

A rabbit inoculated from this lung tissue, very sick thirteen days later, was chloroformed. The place of inoculation is occupied by an abscess situated on thigh and abdomen, and firmly attached fascia. No peritonitis. Spleen very large, of a granular appearance, the size due not to engorgement but hyperplasia. The larger cells have their protoplasm filled with deeply stained granules. A few hog cholera bacilli can be seen. In the liver a few acini have undergone coagulation-necrosis. Cultures in *agar* from the abscess and spleen contain only hog cholera bacilli. It is very probable that the swine plague bacteria were destroyed in the organism of the rabbit as indicated by the large abscess and the condition of the spleen.

No. 15, control animal, died October 4. Spleen very large and gorged with blood. The various lymphatic glands of abdomen, excepting those of mesentery, hemorrhagic throughout. Liver and kidneys not affected. Stomach filled with food. In the lowest 3 feet of ileum are a large number of ulcers varying from the size of a pin's head to one-half inch across. The smallest ones are simply superficial sloughs. As they grow larger they become more and more excavated with thickened, puckered periphery. There are also four or five large ulcers of the same appearance encircling the tube transversely. They are all stained deep yellow. The serosa beneath these opaque. The mucosa of the cæcum and about 6 inches of the colon is converted into a tough, partly yellowish, partly blackish necrotic mass, closely adherent to the muscular coat. Wall in general much thickened. Lower down in the colon there are about six oval ulcers three-quarters inch across, with center black, periphery yellowish (resembling buttons), the whole slightly elevated. The neoplastic growth beneath the superficial slough whitish, firm, extending into muscular coat. Farther down a similar ulcer 2 inches across.

Lungs adherent to costal pleura by their anterior portion and to pericardium. The left ventral and a portion of cephalic lobe solid. Tissue grayish-red on section. A slight pressure forces from the air tubes a thick milky fluid. The principal lobe much congested and oedematous. Of the right lung the ventral is solid and like the corresponding left lobe, excepting that the contents of the air tubes is consistent, like putty, and can be squeezed out in the form of cylindrical plugs. A portion of the azygos lobe also hepatized. The curdy plugs made up almost entirely of agglutinated pus corpuscles. The thoracic lymphatics with hemorrhagic cortex. Right heart contains dark, semi-coagulated blood, no white thrombi.

This case did not present what might be considered swine plague lesions, judging from the foregoing cases and from previous experience. The lung tissue rubbed on covers contained very few bacteria of any kind. A roll culture on the fifth day contained many colonies of hog cholera bacteria. A rabbit inoculated from lung tissue died in twelve days with very large spleen, coagulation-necrosis in liver, and hemorrhagic duodenum. Only hog cholera bacteria obtained from its organs. From the spleen of the same pig a liquid and an *agar* culture contained only hog cholera bacilli.

It is of course impossible to say whether the lung lesions were due to the swine plague germ or not. Certain it is that these organisms die out quite rapidly in lesions as they advance in age, and may thus escape detection. In this case death was due primarily to hog cholera, as the hemorrhagic condition of the lymphatics and the culture indicate.

October 8, No. 6, control animal, found dead this morning. Spleen enormously enlarged. Lungs contain numerous hemorrhagic foci. A small region of one anterior lobe collapsed. No hepatization. From fifteen to twenty ulcers in large intestine. Two cultures from spleen remain sterile.

Nos. 13, 16, and 17 are interesting cases, in that they all presented the lesions of both hog cholera and swine plague in an aggravated form. Nos. 16 and 17 were previously fed with the spleen and large intestine of the Baltimore pig (No. 19) before they were placed in the infected pen September 24. No. 17 was found dead October 9; Nos. 13 and 16, October 11.

No. 13, control animal. Skin over pubic region, along median line of abdomen, inside of limbs, and on throat considerably reddened. Superficial inguinal glands hemorrhagic. Spleen slightly enlarged, dark. Abdominal cavity contained about a pint of fluid, dark-colored fecal matter which had escaped from a perforation in

walls of colon. Extensive pale-yellowish exudation matting the various organs together. Cæcum and colon extensively ulcerated. Lungs diseased. Exudative pleuritis gluing lungs to chest wall. Left lung entirely hepatized with exception of a small region near caudal border. Principal lobe in stage of red hepatization. Ventral lobe in general red on section, with numerous small wavy lines and circles or ovals of a grayish color, representing perhaps cell infiltrations about air tubes. The latter plugged with caseous masses. On this lobe the pleuritic exudate was from one-sixteenth to one-eighth inch thick. Of the right lung the whole ventral lobe was solid, red, mottled faintly with gray; cut surface smooth. Portion of the cephalic lobe in the same condition. Azygos lobe normal. Bronchial glands enlarged, pale pink on section.

In the red hepatized lung tissue and pleuritic exudate a large number of swine plague bacteria could be detected. A rabbit inoculated with lung tissue died in six days with extensive subcutaneous infiltration on thigh and abdomen, spongy, blood-stained. Spleen somewhat enlarged; liver with slight coagulation necrosis. Although we have here the indications of the presence of both germs, only swine plague bacteria were found in an *agar* culture from the spleen.

No. 16, fresh animal. Skin normal; spleen very large, gorged with blood. Liver normal; both kidneys have the medullary portion almost completely absorbed. Ureters distended to a diameter of one-third to one-half inch. Catarrh of bladder. A few stringy deposits on coils of intestine. Lymphatics of large intestine enlarged, indurated, pale. Stomach normal. In lower ileum one large ulcer 2 inches long and several small ones. Large intestine ulcerated. In cæcum the valve is covered with a thin, brick-red slough. Near blind end two button-shaped, flat ulcers, one-half inch across, and a large number of very small ones. In the upper half of colon a few ulcers of similar character.

Feeble adhesion of both lungs to chest wall, barely collapsed. All but the azygos lobe and a narrow dorsal strip of lung tissue in each lung hepatized. A membranous exudate covers the diseased portion, thicker ventrally—easily peeled off. In the right lung the hepatization is dark red, granular. The region of the ventral lobe (middle region) shows dorsally necrotic foci (*i. e.*, lobules, or portions of them, of a homogeneous, pale grayish-yellow appearance, very minutely honey-combed, cutting like cheese, and sharply outlined from the surrounding tissue). The ventral lobe itself below these foci has the air tubes of all sizes filled with caseous cylindrical plugs. The necrotic centers are numerous in the cephalic lobe. The left lung is in substantially the same condition. Bronchial glands enlarged, firm, pale red. White thrombi in all vessels leading to or from heart.

In cover-glass preparations from the recently hepatized lung tissue a considerable number of polar-stained bacteria can be seen. A rabbit inoculated from it died in five days, with extensive pasty infiltration of the subcutis; hemorrhagic points on cæcum; spleen moderately enlarged. An *agar* culture from the spleen contains an abundant growth of swine plague bacteria. Through some oversight the results of cultivations from the spleen of this pig were not noted down.

No. 17, fresh animal. Spleen very large and dark, friable, about 14 inches long, 2½ wide. Superficial inguinals enlarged, with minute petechiæ on section, and small areas and lines of a pale grayish, waxy cast. Complete loss of medullary substance of both kidneys, due to the formation of cysts varying in diameter from one-half to 1 inch. In left kidney about one-half of cortex also gone; four or five papillæ still show on the median section. In the right kidney only one small cyst in cortex. Liver dark, firm to the touch; lobules on ventral surface slightly projecting. On section the center of acini brownish red, the periphery pale. When scraped the parenchyma comes away as a pulaceous mass, leaving a tough honey-combed frame-work (cirrhotic).

Digestive tract: Mucosa of fundus of stomach wine red; at periphery of oesophageal expansion a blackish patch, three-fourths of an inch across, slightly depressed and covered with islands of yellowish slough. In the cardiac region are numerous erosions from one-sixteenth to one-fourth of an inch across; all covered with a soft, whitish deposit. The mucosa of duodenum has its minute vessels injected and about one small ulcer to a square inch, superficial, with slough stained deep yellow. For 2 feet from the valve the mucosa of ileum contains ulcers varying in size, a few very large, with puckered margin. The cæcum, filled with brownish, soft excreta, contains about two dozen ulcers, flattish, center blackish, periphery yellow. The base of these ulcers consists of a neoplastic, whitish, tough tissue. Throughout the colon are small yellowish ulcers, quite superficial, a few even in the rectum.

Thoracic cavity: Right costal pleura and diaphragm of right side covered by a layer of soft, shreddy material, thickest on the latter. The entire right lung covered with a similar exudate of variable density. The anterior (cephalic) half of this lung hepatized; the hepatization varying from a dark red to a grayish red. The air-

tubes are plugged with translucent and opaque whitish plugs. At the caudal tip of the principal lobe a group of lobules, solid, grayish, undergoing caseation. The bronchioles are plugged with white curdy masses, and contain remnants of lung worms. Only one-half of the two anterior (ventral and cephalic) lobes of left lung solid. The remainder of lung oedematous. The azygos lobe completely hepatized, the cut surface of a glistening brownish red, with curdy plugs extruded from the bronchioles on pressure. They are made up chiefly of leucocytes (pus cells). Trachea and bronchi contain a large amount of a viscid, jelly-like material.

Bacteriological examination of the pleuritic exudate revealed among leucocytes a large number of very minute cocci; in some a polar stain is visible. In a few leucocytes the nucleus was situated near one side, and between its two branches the cell protoplasm contained from fifteen to twenty bacteria. A gelatine tube culture made directly from the pleuritic exudate failed to develop. A liquid culture from the same source contained chiefly swine plague bacteria and a few motile hog cholera bacilli. An *agar* culture was covered on the following day with a very delicate growth containing only swine plague bacteria so far as it could be examined. After four days, however, a denser growth invaded the *agar* surface from below, made up of hog cholera bacilli. The lung tissue showed the same organisms in large numbers.

From the spleen only hog cholera bacilli were obtained in a liquid, an *agar* culture, and a gelatine roll culture in which about two hundred colonies appeared.

The following notes refer to fresh pigs (excepting No. 12), which were either simply placed in the infected pen or previously fed with viscera of dead swine. They indicate the decline of the swine plague (lung disease) and a still considerable virulence of the hog cholera.

October 3.—No. 12, vaccinated animal, found dead this morning. Pleural and abdominal cavities contain considerable blood-stained serum. Blood extravasation in muscular tissue of abdomen along median line. Cæcum and upper colon filled with small pebbles. Death from injury. A culture from spleen remains sterile.

October 8.—Nos. 39 and 40, fed with viscera of hog cholera cases October 1, dead this morning. In No. 39 the mucosa of ileum and large intestine was necrosed superficially in the form of a thin layer. Lungs, with exception of a small patch of collapse on left ventral lobe one-half inch square, normal. Spleen contains hog cholera bacilli. In No. 40 the lesions were the same. The lungs were normal but contained lung worms.

October 10.—Nos. 1 and 2, fed with viscera of dead pigs September 31, found dead this morning. In both there was extensive necrosis in ileum and large intestine, while the lungs were normal. Cultures from the spleen of No. 2 contain only hog cholera bacilli.

Nos. 41 and 42 fed together with Nos. 39 and 40, with hog cholera viscera, October 1; both dead this morning. In both the mucosa of ileum and large intestine was necrosed; the lungs were entirely normal. Cultures from the spleens of both on *agar* contained only hog cholera bacilli.

October 15.—No. 467, exposed since September 20, found dead this morning. *Post mortem* changes begun. Thorax and abdomen contain a considerable quantity of bluish-red serum of an offensive odor. Spleen enlarged, congested. Lymphatics of groin hemorrhagic. No ulcers in large intestine, but mucosa highly inflamed. Lungs contain a few hemorrhagic points, otherwise entirely normal.

October 18.—No. 71, exposed October 8, dead this morning. Lungs normal. The lesions are confined to digestive tract. Slight diphtheritic deposit on mucosa of lower ileum. In cæcum and colon, the deep wine-red mucosa is studded with a large number of small ulcers. Culture on *agar* from spleen contains only hog cholera colonies.

October 19.—No. 73, exposed October 8, dead this morning. Spleen enlarged and lymphatics generally hemorrhagic. Lungs contain numerous hemorrhagic centers from one to four lines across. In each ventral lobe a small region collapsed; no hepatization. Kidneys contain hemorrhagic points. Extensive ulceration of cæcum and colon. Culture from spleen contains hog cholera bacilli.

October 21.—No. 74, fed with viscera from diseased pigs October 13, died this morning. Extensive ulceration in both large and small intestines. Spleen engorged. Lungs normal.

October 22.—No. 72, exposed October 8, dead this morning. In this case we again meet with lung disease. Lung small. Left lung roughened on the entire surface, condensing in some places into a delicate mesh-work. The lesser half of principal, the whole of ventral, and portion of cephalic lobe airless. In the principal lobe the hepatization varies from a catarrhal plugging of air tubes and alveoli, near the

caudal tip, to a dark-red croupous condition towards the center of the lobe. The right lung is free from pleuritis. On the diaphragmatic surface of principal lobe are from six to seven patches from one-half to 1 square inch in area of a bright red, mottled regularly with grayish-yellow points. On section these hepatized regions are of a grayish pink, mottled with deep red. The air tubes exude a soapy fluid on compression. The ventral lobe and a portion of the principal lobe in the same condition. Bronchial glands enlarged, firm, slightly reddened. In both bronchi a large number of lung worms, which are very probably the cause of much of the broncho-pneumonia. No inoculations were made from it.

Spleen slightly enlarged, congested. A small quantity of blood-colored serum in the abdominal cavity and some fibrils. Kidneys with numerous hemorrhagic points in medulla. Stomach and duodenum normal; five ascarides lodged in common bile duct. In ileum the walls are triple the normal thickness; the mucosa is converted superficially into a yellow, leather-like, creased surface; when this necrosed mass is forcibly scraped away a deep wine-colored tissue is exposed. In the colon the deeply reddened membrane is studded with about twelve small ulcers to a square inch. In the cæcum the entire membrane is involved down to the muscular coat.

No. 70, exposed since October 8, died this evening. Lungs normal. Lesions limited to digestive tract and as severe as those of No. 72, just described.

October 23.—No. 68, exposed since October 8, dead this morning. Spleen enlarged. Lungs with petecchiæ on surface; no broncho-pneumonia. Mucosa of large intestine deeply congested and beset with very many small ulcers.

October 24.—No. 75, fed with diseased viscera October 13, and since then exposed in infected pen, dead this morning. Spleen enlarged; large intestine extensively ulcerated. Lungs normal.

October 26.—No. 67, exposed since October 8, dead this morning. Ventral surface of body reddened. Spleen enlarged and dark, friable. Lymphatics in general enlarged, indurated, pale. Mucosa of great curvature of stomach intensely inflamed. About seventy ulcers present, partly hemorrhagic. Small superficial ulcers throughout small intestine, with lemon-yellow slough. The entire large intestine contains them, including rectum, about one-eighth to one-half inch across. Slough of a dirty-yellowish color. Lungs normal.

October 27.—No. 468, pig about one year old, exposed since October 1, found dead this morning without any marked signs of previous illness. Spleen enlarged, with numerous hemorrhagic infarcts. Considerable blood-stained serum in abdominal cavity. Lymphatics generally with cortex or entire substance hemorrhagic. A few hemorrhagic spots in stomach. The serosa highly inflamed; several small ulcers near valve. Mucosa of large intestine dotted with petecchiæ and discolored with diffuse extravasation. Kidney with cortex and medulla pervaded with punctiform hemorrhages. Several ulcers with neoplastic base in cæcum. Right lung lightly glued to chest wall. Considerable hemorrhage in this pleural sac. Over the major portion of the pleura of the right lung, after removal, a closely adherent, thin, opaque, false membrane. The tip of ventral and cephalic lobe collapsed. The pleura of the cephalic (anterior) half of left lung covered by a delicate net-work of exudate. * Collapse as in right lung. In general the various lobes are glued together. The lung tissue itself is pervaded with small hemorrhages, and oedematous. No hepatization. Bronchial glands hemorrhagic. From the spleen several cultures (agar and liquid) contain only hog cholera bacilli. These are visible in large numbers on cover-glass preparations of spleen pulp. Gelatine roll cultures show the same organisms.

November 2.—No. 66, exposed since October 18, dead this morning. *Post mortem* decomposition advanced. Peritonitis. Extensive ulceration of lower ileum and large intestine. Ventral lobes of lungs airless. Lung tissue with hemorrhagic points.

November 3.—No. 81, exposed October 22, dead this morning. Large intestine with mucosa highly inflamed and slightly ulcerated. Lungs normal.

November 4.—No. 80, exposed since October 22, dead this morning. Intense congestion of mucosa of large intestine, also numerous ulcers. The mucosa of ileum for 3 feet from valve completely necrosed. Lungs normal.

December 7.—No. 94, exposed since November 28, dead this morning. Ulceration beginning in the large intestine. Lungs with a few hemorrhagic foci; otherwise normal.

December 8.—No. 54, exposed since November 13, dead this morning. Several old ulcers in large intestine. Lungs normal.

In this connection the following case is of great interest, not only in showing the extent to which swine plague may go in the destruction of lung tissue, but also in showing that animals may live for

some time with only a small portion of the lung tissue capable of performing its function:

No. 463 had been exposed to hog cholera at the beginning of 1888, but did not take the disease. It was used subsequently for experiments on purgatives, and dosed with calomel several times. October 1 it was placed in the infected hog cholera and swine plague pen. It had been thin and unthrifty for several months previous, and failed to grow in weight. After staying in this pen for more than three months, apparently resisting infection, it suddenly died January 14. The abdominal organs were in general healthy, excepting the liver, which was cirrhotic. When cut a gritty sensation was imparted to the hand. The stomach was also catarrhal. There were no ulcers in the intestinal tract.

The lungs were extensively diseased. All but about one-fourth of the right lung and one-sixth of the left lung solid. These regions were situated on the dorsal aspect of the principal lobe, and were very hyperæmic. The remainder of the lung tissue (with exceptions to be given) is converted into a yellowish-white, homogeneous mass, having the consistency of rubber to the touch, and cutting like moderately hard cheese. Scraping brings away scarcely any of the tissue. The interlobular tissue and small bronchioles show very faintly or are effaced. In several places the hepatized tissue is breaking down into a pasty, grayish mass. In the left principal lobe a sequestrum, nearly 2 inches in diameter, of a putty-like consistency. The right ventral lobe is also well-nigh converted into the same pasty material, and the center of the azygos lobe is softening.

The various lobes are bound together by tough fibrous tissue. The pleura is everywhere thickened by the formation of bands and patches of fibrous tissue.

In order to test the pathogenic effect of this germ, the following inoculations were made in addition to those upon rabbits already described:

Two fowls which were inoculated into the pectoral with 1 cubic centimeter each of a liquid culture showed no signs of disease. Two pigeons inoculated with $\frac{1}{2}$ cubic centimeter each likewise resisted successfully.

Two mice received about $\frac{1}{2}$ cubic centimeter of a liquid culture under the skin near the root of the tail. One died on the second, the other on the third day after inoculation. In the spleen and heart's blood of both were large numbers of polar-stained swine plague bacteria. In one of them a gelatinous exudate on the pleura consisted of immense numbers of these germs, together with many leucocytes, whose protoplasm was gorged with them. The lungs were in part hepatized. (In both mice the duodenum was greatly distended by masses of tape-worms; in one the liver and kidneys were far advanced in fatty degeneration. These pathological conditions no doubt hastened the fatal result.)

Effect on pigs.—Our past experience with this germ is that it is difficult to predict results of inoculation into pigs unless large quantities are injected. This is particularly true when the germs are obtained from an outbreak of a mild character, as was the case with the one under consideration. The following inoculations without any result confirm this past experience:*

October 8.—From an *agar* culture obtained from a rabbit inoculated with lung tissue (pig No. 9), the condensation water containing an abundant growth of swine plague bacteria was mixed with 10 cubic centimeters of sterile bouillon. A bouillon peptone culture from the same source was added to this, making 20 cubic centimeters in all. One pig (No. 36) was inoculated subcutaneously with 10 cubic centimeters of the culture liquid, one-half into each thigh. No. 37 was inoculated into the right lung through the chest wall, receiving 3 cubic centimeters. No. 38 was inoculated in the same place, 2 cubic centimeters being injected.

No. 36 manifested no ill effects, being watched several months. No. 37 likewise remained well. No. 38 began to decline about a month after the inoculation, and three months after appeared stunted and unthrifty although it ate very well. Owing to its poor condition it was killed January 23. There were no lesions of abdominal or thoracic organs, excepting a few membranous expansions of connective tissue fastening the ventral border of a part of the right lung to the chest wall. Closer examination revealed an old pleuritis, indicated by small shreds of fibrous

* Compare with these similar inoculations made with swine plague germs from a severe Iowa outbreak, reported farther on.

tissue firmly adherent to the convex surface of the same lung. In the cephalic lobe were two or three small collapsed masses. The lungs were sound with this exception.

SOME GENERAL OBSERVATIONS ON THIS EPIZOOTIC.

As already stated, in the latter part of September three pigs from one herd and one from another in the vicinity of Baltimore, Md., were found to contain the lesions as well as the germs of two infectious diseases. One of these pigs communicated both diseases to pigs at the Experiment Station. The swine plague rose rapidly in severity and then fell equally fast, and almost disappeared within a month after its introduction. The hog cholera, however, continued until the middle of January, 1889, with variable severity. Moreover, not all animals took swine plague, while none of them died of that disease alone. Previous observations have shown that swine plague did not last very long, at least not so long as hog cholera when associated with it. That it may, however, become exceptionally severe is proved by investigations made in Iowa in November, 1888, and reported below.

Before speaking of the characters of the disease as observed in this outbreak, it must be said that it is by no means safe to make deductions as to the lesions caused by one disease germ or another in the same animal when we have a double disease to deal with. Hence the brief statements made must be considered merely as opinions rather than positive statements. The lung disease is especially puzzling, in so far as the lesions in different lungs and in different parts of the same lungs are of such different character. I am of the opinion that swine plague causes a pneumonia essentially catarrhal in character. In this outbreak, however, much of the pneumonia appeared croupous, *i. e.*, red, granular. A certain number of cases died of pulmonary hemorrhages, and I am inclined to think that the hemorrhage and the red hepatization were resultants of hemorrhagic lesions of the lung tissue so common in uncomplicated hog cholera. Usually the dependent lobes appeared to be affected with a chronic broncho-pneumonia, upon which the swine plague was grafted secondarily. It was quite common to find the ventral lobes with the air tubes filled with yellowish-white consistent plugs, or else creamy in character, while other portions were involved in simple pneumonia without implication of the air tubes. Knowing, as we do, that broncho-pneumonia is not uncommon both in young pigs free from any infectious disease and in such as die of hog cholera, it is reasonable to suppose that such lungs are especially vulnerable in the presence of swine plague virus.

In a considerable number of cases lobules were found, chiefly in the middle and cephalic third of the lungs, apparently necrosed. On microscopic examination such lobules contained a variety of bacteria, chiefly streptococci, ranged along the periphery of the lobule in large masses or colonies, which were brought out very well by the Gram-Weigert stain. It is probable that the lobule became necrosed because of the plugging of its vessels by thrombi, and that these bacteria invaded it as putrefactive forms. At the same time we must admit that so far as we know the process may be the very opposite.

Frequently the disease process is still more complicated by lesions due to lung worms. In some lungs the caudal tip of the large principal lobe on both sides was converted into a solid, rather hard, grayish-yellow mass, evidently due to the irritation of lung worms which settle in this locality. It is probable that swine plague may start in

such a nidus, although the peculiar hepatization is not originally due to swine plague.

In the cases of swine plague, pleuritis was a common and prominent lesion, directly traceable to the virus. It is not unlikely that pleuritis in old cases of hog cholera is caused now and then by septic organisms entering the serous cavities through the ulcerations in the large intestines.

It is interesting to note the uniformity with which ulceration of the large intestine accompanied intra-abdominal injection of hog cholera bacilli in the vaccination experiment. The superficial character of most of the ulcerations would lead us to assume that the virus had acted upon the mucous membrane from the surface rather than in the form of emboli from the sub-mucosa, in which case we should expect the ulcers to be deep and rather small in size. There was no evidence, except in one case (No. 484), of injury to the wall, and we may have to accept the alternative that only two or three animals were inoculated with insufficiently sterilized cultures, and that the remainder took the disease from these by taking the virus in with the food.

The experiment of intra-abdominal injection of sterilized cultures in large quantities has since been repeated without any accident, and will be reported when completed.

INVESTIGATIONS OF SWINE DISEASES IN IOWA.

In determining upon rules and regulations necessary for the suppression and prevention of infectious diseases it is necessary to know their causes and all that pertains to their life history. As long as these are not fully known the rules that are laid down can only be regarded as provisional and subject to change after more thorough investigations. For the same reason the preventive measures applicable to one disease can not be applied to another if there are differences in the microbes that cause the diseases. We have already demonstrated in this and former reports that all infectious swine diseases in our country are not the same. We have separated them into two diseases, hog cholera and swine plague. Although there is much that is alike in both diseases and in the bacteria causing them, the latter are distinguished from one another in a number of ways, the most important of which is a difference in their resistance to destruction and their behavior in the surroundings of the animals, such as soil, water, etc.

One of the problems before us now is to determine the relative distribution of these two diseases in our country. Are there certain regions overrun by one of these diseases and free from the other? What regions are afflicted with both diseases?

It was to aid in solving these questions that advantage was taken of the reported prevalence of swine disease about Mason City, Iowa, in November, 1888. Owing to the very willing assistance of Messrs. L. M. Van Auken, H. I. Smith, and others, of Mason City, in locating for us the places where the disease existed, and in furnishing valuable information concerning the spread of disease in that section of the country, as well as the readiness with which the owners of diseased swine placed all the means and animals at our disposal, it was possible to examine several animals from three separate farms within two days. Owing to the exigencies of bacteriological work it is necessary to work quickly in order to obtain any results.

Farm A.—The disease appeared about November 1, in a herd of

sixty-five shoats, weighing at the time from 80 to 160 pounds each. They were kept in a one-acre lot at the time the disease appeared and fed upon all the new corn they would eat, together with slops from the house. The pigs were all dead at the beginning of December. Of this herd, three pigs were examined on November 13, *i. e.*, in the middle of the outbreak.

November 13.—Pig No. 1, black female shoat, died either yesterday afternoon or last night, during which there had been a heavy frost. Superficial inguinal glands very much enlarged, dark red. On section, mottled with grayish lines and circles, probably due to cell infiltration of the lymph channels. The ventral lobes of both lungs collapsed, flesh red. Broncho-pneumonia in its early stages; no pleuritis. Spleen but moderately enlarged, not congested. In peritoneal cavity, on coils of large intestine, a few stringy, loose deposits of fibrin. Kidneys normal. On the mucosa of the large intestine a very thin membranous deposit not much thicker than heavy paper. It is easily peeled off, showing a deep wine-red surface beneath. The blind end of the cæcum is converted by a transverse partition of inflammatory origin into a closed cavity larger than a hen's egg. The walls of this sac are at least half an inch thick, and the surface of the partition facing the colon is covered by a thick yellowish mass, partly necrotic, partly neoplastic. This may have been the result of ulceration. An *agar* culture of the spleen made with a bit of tissue remained sterile.

A portion of the mucosa of large intestine and of the diseased lung tissue were placed in sterile, plugged test tubes and kept in the cold.

On December 1, a portion of each was torn up in sterile bouillon and injected hypodermically into two rabbits. The one inoculated from the intestine remained alive and well, but the other died in three days. There was a sanguinolent, cellular thickening of the subcutis of the inoculated thigh and adjacent groin. The thigh muscles under the exudate were of a grayish color and faintly ecchymosed. There was peritonitis indicated by ecchymosis of the serous surface of cæcum and a membranous exudate on spleen and liver. The dorsal wall of the peritoneal cavity and the serosa of rectum were also involved. Liver, spleen, and kidneys much congested. On section the medullary portion of kidneys wells up slightly above the cortical portion. In left lung five to six foci of dark red hepatization. A cover-glass applied to the exudate on spleen shows an immense number of cocci and a small number of leucocytes. In blood and spleen pulp they are rare. An *agar* culture from the latter and a bouillon culture of the former are both pure cultures of what seems to be the swine plague germ.

About one month later (January 3) a fresh rabbit was inoculated from an *agar* culture meanwhile renewed several times. A little of the growth was diluted in sterile beef infusion and $\frac{1}{2}$ cubic centimeter injected subcutaneously. The rabbit died on the fourth day, with extensive lesions of the subcutis of abdomen and thigh, partly yellowish, pasty suppuration, partly ecchymotic. The peritoneal cavity was affected in the same way, the lesions being exudative, partly hemorrhagic. The same organisms injected were found in the exudate and internal organs on cover-glass preparations and by cultivation.

Pig No. 2, small red male. Hair almost entirely shed; very much emaciated; died yesterday. Lymphatic glands of inguinal region enlarged, pale red. Changes similar to those in No. 1, but much less marked. Lungs normal, excepting the very tip of one lobe. Spleen moderately enlarged but considerably congested. Kidneys normal. On opening abdomen, the ulceration of the large intestine was manifest from the serous surface of the coils, between which in the meso-colon there was a gelatinous exudate; the meso-colic glands as large as small beans. The cæcum was glued fast to the adjacent kidney and a clot as large as a marble adherent to the former in another place. When opened, four deep ulcers were found in the cæcum. When the superficial slough was scraped away the tissue beneath was found infiltrated with blood. The mucosa of entire colon was beset with superficial sloughs, chiefly on the ridges, and small round ulcers more sparingly disseminated.

Portions of the diseased mucosa were cut out and preserved in the cold in sterile, plugged test tubes. November 20, a rabbit was inoculated by placing a portion of an ulcer under the skin of the thigh. This rabbit lived until December 7, seventeen days after inoculation. Over the pubis a tumor as large as a hen's egg, which seems to consist of the thigh muscles greatly enlarged by abscesses between the bundles of fibers; contents of abscesses cheesy. Over the abdomen thickening of subcutis, with sero-gelatinous exudate on periphery of thickened area. On epicardium a gelatinous deposit, and in heart muscle about six whitish, homogeneous masses

from one-eighth to one-quarter inch in diameter. Spleen slightly enlarged, dark. No bacteria to be seen in spleen pulp, but the large pale cells have their protoplasm filled with deeply stained (methylene blue) points. In the belief that the local effect of the inoculation was the cause of death, as the rabbit had lived so long, two tubes of *agar* were inoculated with bits of the enlarged thigh muscle. These remained sterile.

On December 1 another ulcer was inoculated by tearing it up in sterile water and injecting $\frac{1}{4}$ cubic centimeter of the suspension of ulcerated tissue. This had been kept in the refrigerator or the outside air since it was collected. It was, however, considerably decomposed. The rabbit died December 11. There was in this case also extensive pasty thickening of the subcutis over the thigh and abdomen about one-quarter inch thick. No peritonitis. Spleen enlarged, dark, softened. Lungs pale; blood dark, coagulated very imperfectly. In the cæcum for about 3 inches from the blind end are about eight ulcers. The surface of the ulcers is hemorrhagic, the base made up of thickened pale-red tissue. The genesis of these ulcers was explained in subsequent cases as a caseous (suppurative) condition of the follicles in the walls of the intestine, which broke through the membrane and caused hemorrhage on the mucous surface. They may have been due to emboli from the inflamed subcutis, which was very likely the cause of the abscesses in the heart muscle of the preceding case.

Cover-glass preparations from the spleen, liver, blood, and subcutaneous infiltrations revealed no bacteria, but a considerable number of leucocytes with elongated or divided nucleus, in the protoplasm of which were numerous punctiform bodies deeply stained (methylene blue). *Agar* tubes were inoculated from liver, spleen, and blood. All but one remained sterile. This contained a motile bacillus very much like the hog cholera germ, but it grew more vigorously on *agar* and liquefied gelatine, besides having no effect on mice and rabbits. The swine plague germ was therefore not obtained in cultures from these rabbits.

At the same time (November 13) a shoat (No. 3) was killed for examination which was reported to have been sick for some time. On the back of the neck there was an area 3 to 4 inches in diameter, from which the skin had sloughed away, and in which the muscular tissue was exposed to view. This may have accounted, perhaps, for the illness, since nothing abnormal was found in the animal excepting collapse of the left ventral lobe of the lungs in which broncho-pneumonia was not yet apparent. The intestines were normal.

Farm B.—The disease had appeared about the middle of October in a herd of 63 shoats and 12 old hogs. By the end of the year 53 shoats and 5 old hogs were dead, and the disease practically extinct. When the disease broke out the shoats occupied a 40-acre corn field, and were also fed with skimmed milk and slops from the house. The old hogs were penned, receiving all the corn they could eat. The examination included the following cases:

November 14, No. 4, small pig, probably died yesterday noon. Temperature of the air below freezing. Emaciated. The disease seems limited to the lungs and digestive tract. The former have the ventral lobes airless, of a red flesh color. In the other lobes are a number of scattered foci of collapse and beginning pneumonia. The large intestines are extensively ulcerated, there being at least three ulcers to 1 square inch of mucosa. In some places the necrosis is in the form of bands parallel to the ridges or folds of the membrane. The lowest foot of the mucosa in the ileum is completely converted into a slough.

From the spleen, which is small and pale, two bits were placed in *agar* tubes, though no bacteria were seen on one cover-glass of spleen pulp. One tube remained permanently free from growth; the other developed a dense whitish, glistening growth, extending upward from the spleen tissue on the surface of the *agar*. In bouillon peptone it grew slightly more turbid than the hog cholera germ, but had the same form and was motile. On gelatine it grew without producing liquefaction. From the liquid culture two mice and a rabbit were inoculated November 28. One of the mice was found dead on the fifth day. In each lung dark red foci of hepatization. Intestines in part blackish, also stomach near pylorus, evidently due to tarry contents, which may have been due to hemorrhage, although it was impossible to decide this point, owing to the small size of the animal. In the small spleen a few bacteria were seen, but no cultures were made therefrom in the expectation of getting better results from the other mouse and the rabbit. But both of these remained well, so no importance was attached to it. The mouse killed with chloroform one month after inoculation showed no lesions of any kind.

On December 1, two mice and a rabbit were inoculated from an ulcer of the same pig kept in a sterile test tube in the refrigerator. None of these animals showed signs of illness thereafter.

No. 5, a small pig, said to have died forty-eight hours ago. On examination no lesions were found in lungs or intestines. Two tubes of *agar* into which bits of the small, pale spleen were put remained sterile.

No. 6, of the same size as the two preceding, said to have died about forty-eight hours ago. The ulceration in the large intestines was as extensive as in No. 4. Of the lungs one ventral lobe was hepatized. From the spleen, which was considerably enlarged and congested but rather firm, two *agar* cultures were made. These remained sterile, although cover-glass preparations had shown the presence of streptococci. Six days later a rabbit inoculated from an ulcer, meanwhile kept in the cold, remained well.

The results of inoculations and cultures from these three cases were thus entirely negative.

Farm C.—The disease appeared about November 1 in a herd of 14 shoats and 2 old hogs. The shoats, weighing from 125 to 175 pounds each, were all dead before November 20. They had been kept in pens with a small yard to run in, and were being fed on all the new corn and water they could consume, together with skimmed milk and slops from the house. From this herd the following animals were examined:

November 14, No. 7, black shoat, weighing about 125 pounds, just dead, the viscera still quite warm. The animal is in very good condition, although the owner claimed that it had lost at least 50 pounds during its illness. The lungs are perfect excepting the tip of one ventral lobe, where a portion as large as a small marble is solid. Superficial inguinal glands very large and with cortex hemorrhagic. Glands of lesser omentum in the same condition. The lower coils of the ileum show under the serosa punctiform extravasations; the walls are thickened and the mucosa itself is concealed by patches of soft yellowish-white exudate about one-tenth inch thick. It is easily peeled off and exposes a deeply reddened membrane. The large intestine, beginning with cæcum, is extensively ulcerated, the ulcers being in general shallow and extended. From the spleen, which was very large and gorged with blood, two bits of tissue were placed in *agar* tubes. These remained sterile. No bacteria could be detected in spleen tissue with the microscope.

From one of the ulcers a rabbit was inoculated November 20 by placing a small bit of the ulcerated tissue under the skin and drawing the incision together with a single stitch. The animal died in six days. The subcutis of the inoculated thigh was considerably infiltrated, on the abdomen only slightly so. On the opposite thigh near the pubis a small patch of hemorrhagic points on the muscular tissue. No peritonitis. Spleen congested, but barely augmented in size. In spleen and blood no bacteria could be detected; the leucocytes there contained the stained particles, as before described. Two *agar* and two bouillon peptone tubes were inoculated from the blood and spleen pulp. All four tubes remained sterile.

No. 8, animal about the size of No. 7, died last night. Superficial inguinal glands with cortex reddened, and occasional hemorrhagic points in medulla, which has a decided greenish-yellow tinge.

All but a narrow portion along the dorsal region of each lung solid, twice as large as in the collapsed condition. No pleuritis. The entire hepatized tissue contains whitish, cheesy masses, from 1 to 4 millimeters (one twenty-fifth to four twenty-fifths of an inch) across, which are consistent, so that the whole lung cuts like liver tissue. The masses are so numerous as to leave but little reddened lung tissue between them; odor moderately putrefactive. Liver has a peculiar mahogany color, indicating stasis of the bile in the bile capillaries and ducts. The acini are plainly outlined, bloodless. Spleen exceedingly large, due to engorgement with blood. In the cæcum a large ulcer near the valve, about $1\frac{1}{2}$ inches across, besides six or seven smaller ones one-fourth to one-half inch across, the yellowish slough slightly projecting.

From the lung a rabbit was inoculated November 21. A bit of lung tissue was teased and broken up in sterile bouillon and injected subcutaneously into the thigh. The rabbit was dead on November 24. The injection had caused considerable pasty thickening of the subcutis on the thigh. The spleen was enlarged and dark colored. Other lesions absent. Cover-glass preparations fail to show bacteria in spleen, liver, and heart's blood. From the spleen and the blood each an *agar* and a bouillon peptone tube were inoculated. The two *agar* and one bouillon tube contained, on the

following day, growths which proved to be made up only of swine plague bacteria. The other bouillon tube contained also a short non-motile bacillus.

Another rabbit had been inoculated at the same time by placing a small bit from one of the ulcers of the cæcum under the skin on the inner surface of the thigh. This animal was found dead November 27. There was in this case but slight suppurative infiltration of the subcutis at the point of inoculation and a few petechiæ on abdominal muscles. Spleen small, dark; liver congested and in an advanced state of fatty degeneration. Cysticerci in omentum. In the spleen, liver, and blood an immense number of swine plague bacteria, showing very clearly the polar stain. Cultures in *agar* and in bouillon peptone from the spleen and heart's blood contained on the following day only swine plague bacteria. A tube of gelatine inoculated at the time failed to grow. Swine plague bacteria were thus obtained from both intestine and lungs of No. 8.

No. 9, in size and weight like the two preceding. So sick that it was thought best to kill it. In this animal there was no ulceration of the large intestines, but in the ventral portion of the left lung the broncho-pneumonia, so advanced in No. 8, was already established. The spleen was moderately engorged with blood. Two *agar* cultures from spleen bits remain sterile. From a bit of lung tissue a rabbit was inoculated into the thigh subcutaneously on November 21. It was found dead November 25. The local lesion involves the subcutaneous connective tissue of thigh and abdomen. The muscular tissue underneath is grayish, discolored. The subcutis overlying it is thickened and softened, partly gelatinous, and infiltrated with blood in the groin. The cæcum directly underlying the subcutaneous inflammation of the abdomen is dotted with hemorrhages, and about 3 inches of the blind end has its walls very much thickened, softened, the serous aspect discolored with blood extravasations, and the mucosa grayish, softened, the contents of a semi-gelatinous, colorless aspect. Slight exudate on the ventral surface of the liver. The subcutaneous and peritoneal exudates contain an immense number of cocci; in the blood they are few in number. None show any distinct polar stain. *Agar* cultures from the peritoneal exudate and from heart's blood contain, on the following day, a growth of swine plague bacteria only.

No. 10, small shoat, died only a few hours ago. All of left lung but a small strip of dorsal region hepatized. The principal lobe is in a condition of dark red hepatization interspersed with areas of a paler color. Over the ventral lobe, on its lateral aspect, an exudate nearly one-eighth inch thick, lamellar, easily scraped away as a yellowish-white pultaceous mass. The lung tissue beneath it in a state of advanced cellular infiltration (broncho-pneumonia). The ventral lobe of the right lung is likewise involved in broncho-pneumonia. In the cæcum near the valve a slightly depressed, ragged, gnawed ulcer about 1 inch across. The mucosa of the entire valve is also ulcerated. No lesions lower down. From the slightly congested but not enlarged spleen two *agar* cultures were made. These remained sterile.

On November 21 a rabbit was inoculated subcutaneously with one-fourth cubic centimeter of an emulsion of the lung tissue in sterile beef infusion. This rabbit remained alive and apparently well. December 17, nearly a month later, it was killed with chloroform. A large ulcer had formed on abdomen, exposing the thickened subcutis firmly attached to subjacent muscular tissue. No peritonitis. Spleen small and pale, liver dark. Stomach well filled with food. In the walls of the cæcum near the blind end about a dozen whitish patches, the largest about three-sixteenths of an inch across, the smallest barely visible. These patches correspond to soft white masses, probably lymph follicles undergoing supuration. In the left lung a small area of hepatized tissue. The process in this case had been localized in the subcutis, and the condition in the cæcum may have been due to embolism.

On December 1 a second rabbit was inoculated in the same way from the same material, kept meanwhile in the refrigerator. The result was entirely negative.

The virulence of pure cultures of the swine plague bacteria obtained from pigs Nos. 8 and 9 by inoculation into rabbits was tested about a month later on rabbits by suspending a loop full of the gelatinous growth from the condensation water of *agar* cultures in about 1 cubic centimeter of sterile water, and injecting one-eighth of this amount subcutaneously. Rabbit inoculated from culture from pig No. 8, January 2, dead next morning—in less than twenty hours. Slight infiltration of the subcutis of inoculated thigh with ecchymoses and discoloration of the subjacent muscle. Lymph gland of groin hemorrhagic. In the internal organs no changes, no peritonitis. Spleen dark, slightly enlarged. In spleen and liver an immense number of polar-stained swine plague bacteria.

Rabbit inoculated from culture from pig No. 9, January 8, died within forty-eight hours. The lesion at the place of inoculation somewhat more pronounced and extending to abdomen. In the latter cavity the cæcum and portion of colon densely sprinkled with subserous punctiform extravasations, portions of rectum and duo-

denum reddened. A grayish viscid exudate between the cæcum and colon, on liver and spleen. The exudate consists chiefly of swine plague bacteria, which are also present in the spleen and blood.

The following table gives the results of cultivation and inoculation experiments:

Date of autopsy.	Swine No.	Spleen cultures on agar made within twenty-four hours.	Rabbit inoculated with ulcer.	Rabbit inoculated with lung tissue.
Nov. 13	1	Sterile	December 1, no result	December 1, swine plague.
	2	.....do	November 20, no result; December 1, doubtful.
	3	.....do .....	.....do
Nov. 14	4	Putrefactive germ in one tube.	One rabbit, two mice, no result.	November 21, swine plague Do. November 21, no result. December 1, no result.
	5	Sterile .....	.....do
	6	.....do	November 20, no result ...
	7	.....do	November 20, doubtful ...
	8	.....do	November 21, swine plague
	9	.....do .....	.....do
	10	.....do .....	.....do
		.....do .....	.....do

From the notes and the tabulated results it will be seen that the disease under examination is not true hog cholera. This is abundantly proved by the absence of hog cholera bacilli from the spleen in all cases examined. In true hog cholera these bacilli are rarely missed when bits of spleen tissue are taken for culture, and in many cases a prick of the platinum wire into the spleen is sufficient to produce a copious growth. In the second place, inoculation of rabbits with material from intestinal ulcers is also quite invariably successful in true hog cholera in isolating the bacilli. Lastly, inoculations of rabbits from diseased lung tissue in hog cholera are successful in most cases. We have in the investigation before us therefore not the slightest evidence that hog cholera germs were present in the diseased animals. It might be objected that some of the inoculations were made so long after the material had been collected that the specific germs died meanwhile or were destroyed by the multiplication of putrefactive organisms. But this objection may be answered by the fact that hog cholera bacilli are very hardy, and could not have been destroyed in the time elapsing between *post mortem* examination and inoculation into animals, which was either seven or sixteen days, as indicated in the table. During this period great care was taken to keep the material in the cold and in a condition favorable to drying (sterile test tubes plugged with cotton wool). Drying fails to destroy hog cholera bacilli, especially when surrounded by or embedded in other material, within one month at the shortest. When these facts are taken into consideration, the disease can not be pronounced hog cholera, although strikingly resembling it in most of the animals examined. There is but one alternative to be considered. The germ producing the disease in the intestinal tract may not be accessible by the methods which were used, *i. e.*, it may not be capable of infecting rabbits and mice and destroying them. It may be limited to the mucous membrane of the digestive tract so that it can not be obtained in cultures made from internal organs, such as the spleen. This theory seemed at first a probable one when a few of the inoculated rabbits died with what appeared to be metastatic abscesses in the walls of the cæcum, in one case in the heart muscle, although all the cultures from these animals remained sterile. It seemed reason-

able to assume that the microbe in these cases multiplied in the abscesses only. When, however, the same disease in rabbits was caused by inoculating them subcutaneously with the contents of the cæcum of healthy swine, this theory was abandoned, for it showed that whatever caused the disease must have been normally present in the intestines, very probably as a putrefactive organism.

From a few cases, however (lung Nos. 1, 8, 9; intestine No. 8), swine plague bacteria were obtained, and without doubt the disease was due to these germs. The lung lesions of Nos. 8, 9, and 10 were well-nigh sufficient to make a diagnosis of swine plague, but the existence of intestinal lesions (ulcers in No. 2, 7) without any appreciable disease of the lungs had not yet been encountered in Eastern outbreaks of swine plague, where extensive pneumonic and less frequently pleuritic lesions have thus far proved the only reliable diagnostic sign. The swine plague theory will likewise interpret the negative results of many inoculations. Swine plague bacteria are easily destroyed by drying, in ordinary water, and in putrefactive media. Some of the animals (swine Nos. 4, 5, and 6) had been dead from thirty-six to forty-eight hours, and meanwhile exposed to a temperature below 32° F. Under such circumstances any swine plague bacteria present in the digestive tract may have perished even before the autopsies were made.

Taking these examinations, together with previous work on swine plague in the East, into consideration, we must, for the present at least, regard the disease not hog cholera but swine plague, basing this inference on the absence of hog cholera and the presence of swine plague germs. The negative results from the cases examined on Farm B are explained by the perishable nature of the swine plague germ, especially in the putrefying contents of the intestinal tract.* The following very interesting case certainly favors the theory that swine plague alone was decimating the hogs in that locality:

A gentleman near Mason City, Iowa, had lost during the fall about 45 swine, valued at \$800. The last ones succumbed about six weeks ago. Several opened by him had the lungs badly diseased. The intestines were not examined. One of the animals had survived the disease and was now (November 14) to all appearances recovered and in very good condition. The owner, however, was willing to sacrifice the animal, as he believed the lungs diseased. On *post mortem* examination the abdominal organs were found healthy but the lungs extensively diseased. The left lung was firmly adherent by short bands of connective tissue fibers to the ribs and diaphragm, so that it was well-nigh impossible to remove it without considerable laceration. It was shrunken to a small mass, and in its substance were six or seven cavities as large as marbles filled with a soft, pultaceous matter. The walls of these cavities were at least one-eighth inch thick, made up of dense fibrous tissue and stained uniformly on the inside a dark bluish red. The right lung was adherent in several places to the ribs, but contained no abscesses.

* In view of the result of investigations made in the laboratory of the Bureau during the first half of 1889, on an outbreak of swine disease in Maryland, it is not improbable that the swine disease under consideration is likewise a mixture of two diseases, swine plague and a peculiar, modified form of hog cholera, to which the intestinal lesions in most of the cases may be due. The bacillus of this modified form differs in many respects from the bacillus of true hog cholera, and demands for its detection a procedure quite different from that which is sufficient for the true hog cholera bacillus.

This case is chiefly of value in showing that the disease was limited to the thoracic cavity. The infection, introduced most likely through the air passages into different regions of the lungs, caused at the places of deposit pneumonia, resulting in direct necrosis or in cell infiltration (catarrhal pneumonia, broncho-pneumonia) and subsequent caseation. The pleura were at the same time involved by extension of the disease process. The animal had recovered from the attack, so far as recovery was possible, with a lung riddled with cavities and firmly bound to the chest wall. It would have been very desirable to determine by inoculation into rabbits whether the cheesy contents of the lung cavities still contained the living germ, but this was impracticable at the time.

Some additional statistics on the spread and severity of the same epizootic around Mason City were kindly furnished by Mr. L. M. Van Auken. On December 1, the first farm north of the one designated as Farm C in the preceding pages was overtaken by the disease. Of 14 old hogs and 62 shoats, weighing from 150 to 220 pounds, 2 old ones and 24 shoats succumbed up to the second week in January. The animals when overtaken by the plague were kept in a yard of about 1 acre and fattened on soft corn. A farm north of the latter was subsequently infected. After 5 or 6 had died the rest were shipped. One of the dead animals was examined by the owner, and the lungs said to have been very badly diseased. Other herds in the same vicinity were swept away at nearly the same time.

Most of these farms were visited by the plague for the first time last fall. The disease is said to have been introduced through hogs taken from the stock-yards in January, 1888. The disease seems to be as virulent as hog cholera, and is to be dreaded as much as the latter disease, considering the rapidity and certainty with which it spread from one place to another and the high percentage of mortality, amounting in many farms to 100 per cent.

SOME OBSERVATIONS ON THE BIOLOGY AND PATHOGENIC ACTIVITY OF THE SWINE PLAGUE GERM FROM IOWA.

In form this organism does not differ from the swine plague bacteria obtained from various sources, East and West, since 1886. In the tissues of rabbits, when these succumb within one or two days, the germs appear as polar-stained bodies. In other words, when stained in dried films on cover-glasses, the oval germs have both extremities deeply stained, while the central transverse portion or band is nearly colorless. The reader is referred to the report for 1886 for further details concerning the form of this germ. In those rabbits which do not die in so short a time, and in which the disease develops into a peritonitis (when inoculation is practiced on the thigh), the germs, although exceedingly abundant in the peritoneal exudate, do not all show this polar stain. They resemble solid micrococci more nearly. Their identity with the polar-stained forms is easily settled by cultivation and inoculation into fresh animals.

In cultures the germ is non-motile. It grows especially well in beef peptone *agar* at 37° C. In bouillon, with or without peptone, it grows very feebly, barely clouding the liquid. On the surface of boiled potatoes no growth takes place as a rule, even when kept in a moist atmosphere of 37° C. Only once was a faint development observed with the naked eye. The growth was smooth, pure white,

or faintly cream color. In order to detect its presence it was necessary to catch the reflection of the light at a certain angle. This positive result among so many negative ones may be due to differences in the chemical reaction of the potato used. Growth in gelatine at the temperature of the room took place in some instances, in others it failed, so that it could not be depended upon and *agar* was used almost exclusively. Its resistance to drying was tested with the aid of methods detailed in former reports. Cover-glasses sterilized by heat and placed under a sterilized, inverted, and plugged funnel received a little of the growth on *agar* or bouillon peptone. A few hours suffice to dry them out thoroughly. Twice a day cover-glasses were dropped into culture tubes containing bouillon to note any multiplication that might take place. The dried germs from *agar* cultures were capable of multiplying in the bouillon up to the sixth or seventh day. Bouillon into which cover-glasses were placed after that time remained uniformly clear. When dried bouillon cultures were tested in the same way the germs were found to be dead after thirty-six hours. It seems, therefore, that germs massed together, as in *agar* cultures, can withstand destruction by drying longer than those disseminated in liquids. While the former lived in the dried state about six days, the latter lived only one and a half days. The same curious fact has been determined with reference to hog cholera bacilli. Thus in a recent laboratory experiment hog cholera bacilli from bouillon peptone cultures lived thirty-six days in a dried condition; those from *agar* cultures twenty days longer.

Pathogenic properties.—As in biological characters so in pathogenic power, the Iowa germ seems to agree with the swine plague bacteria of former investigations. Its effect upon rabbits has been detailed in the preceding pages. Briefly it may be said to produce in them suppuration and hemorrhagic lesions in the subcutis and in the peritoneal cavity. More rarely it produces a true septicæmia, which must be regarded simply as a heightened effect.

Their pathogenic effect on pigs was tried in various ways by hypodermic, intra-thoracic, and intra-abdominal injection of pure cultures.

December 1, one pig, about five and one-half months old (No. 88), received subcutaneously into each thigh 5 cubic centimeters of a bouillon peptone culture derived originally from Iowa pig No. 8. No result.

At the same time No. 86, of the same age, was inoculated into the lungs; 9 cubic centimeters of a culture from the same source was injected through the chest wall into the right lung with a hypodermic syringe having a needle about 3 inches long. The skin at the place of injection was first disinfected with $\frac{1}{10}$ per cent. solution of mercuric chloride.

The pig was found dead next morning. At the autopsy the superficial inguinal glands were found with reddened cortex, the spleen large and gorged with blood. One or two ounces of slightly cloudy serum in the abdominal cavity; a few threads of fibrin stretched over the ventral surface of intestines. The meso-colon attaching the two middle loops of colon deeply reddened; the glands of meso-colon and cæcum also deeply congested throughout the parenchyma. The mucosa of the colon slightly reddened; the large patch of follicles near the valve considerably reddened. Gastric glands with cortex and more or less of parenchyma reddened.

In right pleural sac 2 to 3 ounces of blood-stained serum; none in left side. The entire pleural lining of the right side reddened and covered by a very delicate network of exudate, which is easily scraped together into a soft, pulpy, yellowish mass. Both lungs collapsed, but considerably congested.

In the pleural exudate and in the parenchyma of the right lung are large numbers of polar-stained bacteria. In the spleen an immense number of the same organisms are present. In cultures obtained from this organ they are identical with those injected on the preceding day.

This experiment shows the different effect of inoculation, under the skin and into the thorax, of the same quantity of culture-liquid. While there was no effect from the former, the latter caused an acute septicæmia fatal in less than twenty-four hours.

A second experiment was tried in order to obtain, if possible, the lung disease as found in spontaneous cases.

December 6, two pigs (Nos. 43, 47) were inoculated into the thorax as already described, No. 43 receiving $1\frac{1}{2}$ cubic centimeters of a bouillon peptone culture originally derived from Iowa pig No. 1, and No. 47, 3 cubic centimeters of the same culture liquid.

No. 47, inoculated at 8 a. m. Temperature on the following day, 4.30 p. m., 105° F. Ate nothing during the day. Respirations labored, abdominal. December 9, temperature, $104\frac{1}{2}^{\circ}$ F.; scarcely able to stand; respirations accompanied by a groan. December 11, temperature, $102\frac{1}{2}^{\circ}$; very weak and failing until killed December 11. At the autopsy the spleen was found small, pale. Abdominal organs and lymph glands in general normal.

The right pleural sac contains a considerable quantity of blood-stained serum. The pleura of the lungs, the diaphragm, and the chest wall of the side highly inflamed, thickened, and covered by a thick, loose, and spongy exudate, easily scraped away. The ventral lobe of the right lung is solid, the hepatization dark red ventrally, with five or six lobules necrosed and of a pale-yellowish color. Dorsally in the same lobe the necrosis is more extensive and very likely represents the region where the needle entered the lung tissue. On epicardium a thick, soft deposit, the pericardium much thickened. The left lung normal, but adherent in several places. Of six cultures on *agar* made from the pleural and the epicardial exudate all but one are pure cultures of a germ identical with the injected swine plague bacteria. Of three cultures from the spleen one remained sterile; the remaining two contain only swine plague bacteria.

If this animal had been permitted to live longer the lesions would without doubt have been more extensive in the lung tissue itself. As it was, they are sufficiently severe and characteristic to prove the pathogenic power of the bacteria injected.

No. 43, which received but $1\frac{1}{2}$ cubic centimeters (about one-third dram) of the same culture, showed signs of disease immediately by remaining quiet, refusing food, and breathing laboriously. Five days later, temperature still above normal ($105\frac{3}{8}^{\circ}$). From this time on it became somewhat better; its appetite returned in two weeks. It did not fully recover, however. One month after the inoculation it was generally unthrifty with staring coat and enlarged abdomen. It was killed January 23. The abdominal organs were normal. In the thorax both lungs were found everywhere adherent to the chest wall and diaphragm by a continuous mass of fibrous tissue not yet very firm. The lungs themselves were not diseased. The pericardium, however, was very much thickened, and when slit open a mass of white cheesy pus was found under it, entirely encircling the heart near the base. About 12 cubic centimeters of this cheesy mass was removed. The inner surface of the thickened pericardium was dark, bluish red. Without doubt the needle, instead of penetrating the lung tissue, had entered the pericardial sac and deposited a portion of the culture liquid in it, converting it into a veritable abscess cavity. Two *agar* tubes inoculated from this pus contained a moderate number of colonies which were made up of swine plague bacteria. They had thus remained alive one month and a half.

In order to observe the pathogenic effect that might be exerted by this germ when deposited in the abdominal cavity two pigs (Nos. 138, 139) received 5 cubic centimeters and $2\frac{1}{2}$ cubic centimeters, respectively, in this situation. The material used was a bouillon peptone culture twenty-four hours old, made from *agar* culture originally derived from Iowa pig No. 9. The result was negative so far as any severe effect was anticipated. No. 138, inoculated December 27, remained very quiet for several days, and could only be made to get up with difficulty. At the end of the third day the temperature was 105° F. At the end of the week it had nearly recovered.

No. 139 showed the same symptoms at first, but recovered more rapidly and was apparently well in five days after inoculation.*

NOTES ON TWO OUTBREAKS OF SWINE DISEASE IN VIRGINIA AND MARYLAND.

Virginia.—On a farm near The Plains, Va., an infectious disease appeared among the swine in October. There were on the farm at that time about sixty-five shoats, from three to five months old, weighing 60 to 100 pounds each. The disease was at its height in November, and disappeared at the end of the year. Up to this time about forty-three had succumbed. The pigs were born on the place, and had been running in a large range following the cattle until the disease appeared, when they were penned. They died so rapidly that they were all turned out again.

The origin of this disease is very obscure. The past history does not give any clew to its introduction. During the great swine epidemic three years ago this farm was not spared, but since then it had been free until January, 1888, when out of a lot of forty similar shoats seven died. Some of this lot were still on the farm at the beginning of the present outbreak. That the January outbreak was due to an infectious disease seems hardly probable considering the small number that died. At time of the last outbreak the disease did not exist in the neighborhood. No swine had been brought upon the farm for five years. There was no evidence of infection from streams, since the farm is situated on a water-shed. The feed is likewise grown on the farm.

Information of this outbreak was received more than a week after the last shoat had died. Dr. Kilborne visited the farm January 9, at which time these facts were made known to him. Two of the convalescents were killed and the lungs brought to the laboratory, they being the only visibly diseased organs.

On inquiry the following general facts concerning symptoms were obtained: No redness of skin on trunk or ears. Rapid emaciation with tucked-up appearance of abdomen; frequent prolonged coughing almost to suffocation. Of the two killed, one had been sick for six weeks, but was now partly recovered and in good flesh. There were no lesions of the abdominal organs. The thoracic organs, however, showed traces of a severe inflammation. The pericardium was extensively adherent to the heart muscle by short fibers and the latter covered by a thin layer of newly formed fibrous tissue. Both lungs were more or less adherent to ribs and diaphragm by strong fibrous bands. The most conspicuous thing was the enormous enlargement of the glands at the root of the lungs (tracheal, bronchial). They appeared like a bunch of large grapes of a bluish-red color. On section the cortex appeared as a red line, and similar lines passed through the parenchyma, which had a pale lardaceous appearance. The lungs were about twice the collapsed size, very flabby, the various lobes bound together by short, firm fibers.

A large portion of the principal lobe is airless, of a pale red-color on section, and cedematous. The bronchi have their walls thickened (peribronchitis). The remainder of the lung tissue is in practically the same condition. The large air tubes have the mucosa covered with a layer of glairy mucus, the small vessels injected.

One of two rabbits which received $\frac{1}{2}$ cubic centimeter of a hypodermic injection of lung emulsion died in four days, with extensive pasty thickening of the subcutis of thigh, discoloration of subjacent muscles, gelatinous exudate over the groin and on muscles of abdomen. In the latter cavity the cæcum and contiguous portion of colon are covered with minute subserous hemorrhages. The exudate is slight, covering in part the inflamed intestines and the liver, viscid so as to be drawn out into thin threads when coils of intestine are lifted up. Very many coccus-like germs in this

* Recently an abdominal injection from *agar* cultures derived from pig No. 8 (Iowa) produced intense peritonitis, pleuritis, a *croupous exudate* on the mucosa of nearly two-thirds of small intestines, and an intense reddening of the mucosa of the large intestine.

exudate, very few in blood and spleen. An *agar* culture from the blood fertile. In all respects the germ is identical with that of swine plague.

A rabbit inoculated from the *agar* culture of the first rabbit indirectly, by injecting subcutaneously $\frac{1}{2}$ cubic centimeter of a bouillon peptone culture made from it died in four days with substantially the same lesions, excepting that the thigh muscles were more extensively discolored.

The second rabbit inoculated from the lung tissue of the pig died in eight days. The lesions of this animal were of the same character but less severe. The hemorrhages on the intestines were absent, though the exudate was abundant. From the blood two *agar* tubes were inoculated; both developed an abundant growth of the same bacteria (swine plague) obtained from the first rabbit.

The condition of the second pig when killed was like that of the first. The abdominal organs were normal. The lungs were free from adhesions. Throughout all the lobes of both, but especially along the margins of principal lobes, are masses about the size of a marble, or in the form of a thin layer under the pleura, of a waxy, semi-translucent aspect, on section solid. The remainder of the lung tissue cedematous.

Two rabbits were inoculated from lung tissue. Of these, one died on the fourth day. There were no lesions to account for death; no germs in the various cultures from its organs. The second rabbit remained well.

From the spleen of each pig three *agar* tubes were infected with bits of spleen tissue. The three cultures made from the second pig remained sterile. Two from the first also remained sterile. In the third tube a germ like swine plague appeared which failed to develop when transferred to fresh tubes.

It is highly probable that the outbreak was swine plague, although the presence of swine plague germs in one case can not be regarded as conclusive evidence. It is remarkable that these germs should still be present in an animal almost recovered from the disease.

Maryland.—The cases reported below were very likely affected with hog cholera, although the bacteriological examination, as far as it went, gave negative results. It seems reasonable to suppose that when swine roam over a considerable extent of territory in search of food the virus is more widely distributed but less concentrated. Less virus is therefore taken up by individual animals, and although the disease is equally fatal in the end, the course may be somewhat different and the lesions less extensive. At the same time the bacteria may elude observation. They may remain more or less localized, owing to the reactive power of the organism, which destroys those that have entered the internal organs. To those who would give up the search for hog cholera bacilli after a few unsuccessful attempts to find them we would recommend the perusal of the following three cases:

Swine diseases prevailed more or less in Montgomery County, Md., during the latter weeks of September and the early part of October, 1888.

October 17.—Mr. H—— lost about twenty-two out of a herd of fifty-five to sixty swine during the past four weeks. Of those now scattered in a large field two appear ill; one, a small black shoat, is killed by cutting its throat, and examined. The superficial inguinal glands are very much enlarged, the surface mottled, dark red; the spleen large, but pale and rather firm. The liver shows signs of invasion of the *Sclerostoma pingvicol*a. The lymphatic glands at lesser curvature of stomach are very large; cortex completely hemorrhagic.

The left lung normal; the principal lobe of the right lung has in it a mass of tissue involved in broncho-pneumonia, extending obliquely from the free border to near the dorsal region, about 1 inch thick. The lymphatics along the dorsal aorta are likewise hemorrhagic; the stomach filled with food; small intestines contain a number of attached *echinorhynchi*; the large intestines distended with semi-solid fecal matter. The mucosa, in general, is normal, but in the cæcum are two ulcers about three-eighths of an inch across, round, slightly elevated, with center black and periphery yellow. Beneath the superficial slough is a whitish, firm, new growth, extending to the muscular coat in the center of the ulcer.

The spleen and the right lung were taken to the laboratory. From the former cultures were made on *agar*, in gelatine and beef infusion, by adding bits of spleen tissue as large as peas. In no tube did any development take place. A rabbit in-

oculated by tearing up a piece of hepatised lung tissue in sterile beef infusion and injecting the turbid liquid subcutaneously remained well.

Several miles from the first farm we came upon a herd of young pigs which were just showing signs of disease, although none had been lost. One of them, with unsteady gait, which hid in the litter under a shed and returned to it when driven away, was killed by bleeding from the vessels of the neck. The lungs were without a sign of disease. Spleen enormously enlarged and gorged with blood. The lymphatic glands of groin and about stomach very large, but rather pale, and cedematous on section. Stomach filled with food. Large intestines overdistended with very dry, hard feces, somewhat softer near cæcum; in the latter only one ulcer, and this on the valve about one-fourth of an inch across, and of the same nature as the one found in the preceding case.

A portion of the spleen of this animal was taken to the laboratory and cultures made as in the previous case, with bits of spleen. All cultures remained permanently sterile.

Several miles from the latter place we found the disease on a farm situated on a hill. The swine were allowed to go a considerable distance down the slope to a marshy stream. The owner had lost 6 or 8 out of a herd of 20 to 25 within six weeks. A few were evidently ill, but none were killed, as a dead one was found. It had probably died during the night. The buzzards had consumed nearly all the intestines through a small hole near the pubis. Putrefaction had already set in. Spleen enlarged, slightly congested. In the small portion of the large intestine, which still remained, an ulcer was found three-eighths inch across. The glands or lesser omentum with hemorrhagic cortex. The stomach contains a small quantity of bile-stained fluid. Both lungs glued to chest wall by coagulated fibrin from blood extravasation. Left lung contained about ten to fifteen hemorrhagic foci, visible under pleura, one-fourth to one-half inch across. The principal lobe of right lung solid, granular, evidently broncho-pneumonia. The hepatised lobe was discolored by recent and extensive blood extravasation. A gelatinous deposit under sternum resting on pericardium. The semi-decomposed condition of the animal prevented a more careful examination. Portions of the spleen and hepatised lung tissue were taken for examination.

While the spleen of the two preceding cases showed no indications of bacterial life on cover-glass preparations, the spleen of this case contained a considerable number of bacteria resembling hog cholera bacilli very closely. On gelatine they grew differently from the latter, and the cultures emitted a slightly offensive odor. In liquids they were actively motile. They were putrefactive bacteria, without effect upon two rabbits inoculated with large quantities of the cultures. A rabbit inoculated with the diseased lung tissue remained well. The latter, on closer examination, had a texture as granular as the roe of fishes, the granules being inspissated cell masses in the alveoli and air tubes. At least four different kinds of bacteria were present in large numbers.

The absence of specific disease germs from the spleens of these pigs is in harmony with the results obtained in other infectious maladies when animals are killed in the early stages or during the height of the disease. It is only in the last stages that the bacteria are able to multiply and appear in sufficient numbers in the internal organs to be detected. In the third case, death was very likely brought on by the pulmonary hemorrhage not infrequently found in hog cholera. The specific bacilli produced at first the ulcers, and were either working their way slowly into the internal organs or else were being destroyed in the ulcer itself. The latter termination would signify recovery, the former death. These ulcers might be aptly compared to the malignant pustule in man, in which the virus remains at first localized but may spread throughout the system after a time. The presence of numerous ulcers in swine is to be regarded as a multiple infection, while in the three cases just cited the infection was limited to a few foci or but one. The ulcers would no doubt have revealed the virus, but our previous experience with the spleens of diseased swine made it seem unnecessary to study the ulcer itself. As regards the lung disease of the third case nothing positive can be said. It resembled most closely chronic swine plague. The germ of this disease was not present, however, as shown by the rabbit inoculation.

PREVENTION OF HOG CHOLERA.*

ISOLATION, DISINFECTION, AND CLEANLINESS AS PREVENTIVE MEASURES.

It is frequently necessary to apply preventive measures before infectious diseases have actually appeared in a herd. The disease may have appeared on a neighboring farm and the problem then arises, How can the disease be prevented from spreading to other farms? How can the surrounding farms keep the disease from their premises?

The sources and channels of infection are as follows, the most common and important being placed first:

(a) Pigs purchased from infected herds, or coming in contact with those from infected farms, or running over ground occupied by diseased swine within a period of two or three months.

(b) Infected streams may communicate the disease to herds below the source of infection.

(c) Virus may be carried in feed, implements, and on the feet and clothing of persons from infected herds and premises.

(d) Winds, insects, birds (particularly buzzards), and various animals may transport hog cholera virus.

(a) In regard to *a*, it may be said that no pigs should be purchased from any locality until one year after the death of the last case of cholera. There are frequently, near the end of an epizootic, chronic cases which may live for three or four months without showing any distinctive signs of disease until they suddenly die. The *post mortem* examination usually reveals extensive ulceration of the large intestine. The disease may thus linger in a herd long after all danger has apparently subsided. By bringing any chronic cases in contact with hitherto unexposed healthy swine the disease may spring up anew, as a dying fire would among fresh fuel. Although our experiments have shown that the disease germs may all disappear from the soil in three or four months, the uncertainty of knowing whether there are any chronic cases continually adding fresh virus to the soil makes the period of one year not too long. It is advisable, in districts where hog cholera is very prevalent and is rarely absent for any length of time, for farmers to raise their own pigs and not trust to any animals from outside. In this way infection may be at least in part kept under control. When animals have been obtained from places which are not above suspicion, they should not be brought in contact with swine already on the place, but quarantined as far as possible from them and kept under careful observation for at least one month.

(b) Perhaps the most potent agents in the distribution of hog cholera are streams. They may become infected with the specific germs when sick animals are permitted to go into them, when dead animals or any part of them are thrown into the water, or when pig pens are drained into them. They may even multiply when the water is contaminated with fecal discharges or other organic matter. Experiments in the laboratory† have demonstrated that hog cholera bacilli may remain alive in water for four months. Making all due allowance for external influences and competition with other bacteria

* Equally applicable to swine plague.

† See bulletin on hog cholera.

in natural waters, we are forced to assume that they may live at least a month in streams. This would be time enough to infect every herd along its course.

(c) Hog cholera germs are not immediately destroyed by drying. Laboratory experiments show that they may retain their vitality from two to four months. Hence it is not difficult to see how a person walking on infected ground and among infected animals may carry on his shoes and clothing dried germs of the disease to any neighboring herd. For the same reason, hog cholera germs may be carried from infected grounds to others by feed, and by farming implements which have come in contact with infected ground.

(d) There is no reason to suppose that currents of air have much influence in spreading the disease. Observations at the Experiment Station of the Bureau have left no doubt that healthy pigs may be kept on the same farm with diseased ones in pens not more than 100 feet from the sick without becoming infected, provided the infection is not carried in feed and implements, or on the shoes and clothing of persons, from the sick to the healthy. Moreover, the disease is an intestinal malady, and all evidence points to infection through the food rather than through the air inspired.

The agency of flies and other insects is, perhaps, equally limited when infection is to be carried from one place to another. Our experiments show very well that the sting or bite of an insect can not be sufficient to produce the disease. It is possible, however, that they may carry the virus from one place to another in the same yard. This will be discussed more fully under another head.

The agency of buzzards in distributing the disease in the Southern States seems probable, although there is no positive proof. These birds will readily consume carcasses of dead swine. If the hog cholera germs are not destroyed by digestion it is reasonable to assume that the feces contain the living germs, which may cause the disease to break out at some distant place. Of course the remedy would be to immediately destroy or bury dead animals.

There is some reason to believe that rats, dogs, and perhaps other small animals may carry the germs upon their feet or in their hair and thus infect premises. It is probable that the contagion is only rarely transported in this manner, but there are outbreaks the origin of which it is difficult to explain otherwise.

Granted, then, no communication between infected and uninfected farms, there still remains the danger of infected water-courses, upon which it is impossible to lay too much emphasis. In fact, if the disease exists anywhere along a stream all farms below that point are liable to infection unless use of the water in any form whatever is given up during the season.

By paying particular attention to these points there is no doubt that the disease can be warded off even when in the immediate neighborhood. Hog cholera is analogous to typhoid fever, dysentery, and Asiatic cholera in man in many particulars, and there is a quite unanimous opinion that these diseases are most commonly transmitted through drinking water. The same may be predicated of hog cholera, and the mysterious spread of this plague will no doubt frequently be understood by examining the water-courses.

When the disease is in the neighborhood it has been customary with some to feed swine on a so-called "preventive" medicine. These are frequently prepared or invented by individuals who have little, if any, knowledge of the action of medicines. The outcome

is that the animals fed with these unknown compounds are not only not benefited, but their vitality is actually reduced, and when the disease appears it destroys the weakened animals much more easily. The writer has made *post mortem* examinations of several animals in the West where such preliminary treatment was going on, and the peculiar changes of the internal organs, not like any known disease, could only be referred to the action of such preparations. It must be remembered that there are very few medicines which are not injurious or poisonous in large doses. They should not be used excepting under special conditions, and only given as recommended by those who have been trained to know the peculiar value and effect of drugs.

The condition of the animals themselves is of great importance in favoring or preventing infection. When pigs are fed with liquids in which the specific bacilli only are present, those that have been deprived of food for some time previous take the disease, while those whose stomachs contain food that is undergoing digestion do not take it readily. If, besides starving the animal, they are fed with some alkaline solution by which the alkalinity of the stomach is increased, the pathogenic effect is still more pronounced. Any disorder of digestion by which the secretion of gastric juice is diminished or checked and the mucus is increased in quantity will increase the susceptibility of the animal to infection, because the alkalinity of the mucous membrane will favor rather than destroy the virus. Any mode of feeding which produces constipation and overdistension of the large intestine is likely to favor the disease, as the virus is retained for a longer time. During epizootics, therefore, besides the preventive measures suggested, the animals should be carefully fed upon food which tends to keep the bowels open and the feces soft, and which does not interfere with normal digestion.

When there is a suspicion that a herd has been infected, although the disease has not yet appeared, disinfection and all the rules laid down below, as if the disease were actually present, should be carried out with great care.

When hog cholera has appeared in a herd or on a farm, precautions should be taken for two reasons: (1) To prevent the virus from being carried to other farms and infecting other herds; (2) to prevent the loss of the entire herd, or, if this is not possible, to stamp out the disease in such a way that the ground shall not infect healthy animals subsequently introduced.

The rules under the first head should be prescribed by law to protect property from the consequences of the carelessness or the willfulness of those who refuse to take proper precautions. They may be summarized as follows:

(a) The dead animals should be immediately disposed of either by burial or by burning, or if they are taken to some rendering establishment their transportation should be governed by well-defined rules which will prevent the dissemination of virus on roads, in wagons, cars, etc.

(b) Streams should be carefully protected from pollution.

(c) No animals should be removed from any infected herd or locality to another free from the disease, except for slaughter, for at least six months after the last case of disease has died or recovered.

(a) The proper disposal of dead animals is a matter of great importance, for the bodies not only contain the germs of the disease, but the latter will multiply enormously during summer heat in the internal organs after life has been extinguished. Each dead body must therefore be regarded as a focus of the disease unless properly

disposed of. It may be buried. In such case it must be so deep that no animal can get at it. It should be covered by a layer of powdered or slaked lime several inches thick, and the ground over the body likewise sprinkled with a thin layer of the same. If the carcasses are burned, care should be taken that any parts not consumed are buried as directed. If they are carried away some distance to rendering establishments, employes of such establishments should be compelled to wrap around the carcasses strong cloths wetted with a 2 per cent. solution of carbolic acid, so as to protect the roads from the virulent drippings.

(b) The danger from infected streams has already been mentioned at length. These must be protected by law in such a way that no sick animals should be allowed to go near them, and that no carcasses be thrown into them or deposited where drainage may carry the virus from the body into the water. Nor should the drainage from pens be permitted to flow into them.

(c) Hogs are frequently affected with cholera of a mild form, which lasts several months before some form of septic infection or degenerative changes in the internal organs produce death; hence it is important to insist upon knowing when the last case of disease occurred. Since it has been demonstrated that hog cholera germs may remain alive in the soil from three to four months, this rule will not appear unreasonable as a safeguard.

These rules will be sufficient, if properly executed, to confine the disease within narrow limits. There is no doubt that hog cholera virus dies out over the greater part of our country after epizootics have swept over it. We have no reason to believe that it can survive in the soil from one end of the year to the other. It is, in fact, highly probable that it is transported and distributed from a few places where for some reason cases have occurred throughout the year and have thus kept the virus alive. There are no experiments on record which show that the hog cholera germs may be found in the soil and water independent of the disease. They have been looked for but have never been found excepting in the body or discharges of diseased swine.

In view of the fact that the disease can be kept under control, the legislatures of those States which suffer most severely from this plague should take steps to enact rules similar to those formulated above. The States of Kansas and Nebraska have on their statute books laws of this character, which read as follows:

KANSAS.

AN ACT to prevent the spread of disease among swine.

Be it enacted by the legislature of the State of Kansas, It is hereby made the duty of every person who owns or who has the control of any hog that has died of any disease to bury or burn the same within twenty-four hours after such hog has died; and any person who knowingly fails or refuses to comply with the provisions of this section shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding one hundred dollars.

SEC. 2. Whoever shall knowingly barter or sell any hog afflicted with any disease without giving full information concerning said disease shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding one hundred dollars.

SEC. 3. Whoever shall knowingly barter or sell any hog which has died of any disease shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding one hundred dollars.

SEC. 4. Whoever shall throw or deposit a dead hog in any river, stream, creek, or ravine shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding one hundred dollars.

NEBRASKA.

AN ACT to prevent the spread of hog cholera and other kindred diseases, and prevent traffic in animals dying from infectious or other diseases.

Be it enacted by the legislature of the State of Nebraska, That it shall be the duty of the owners of swine or other domestic animals dying from cholera or other diseases, within twenty-four hours after their death, to cause the carcasses of such animals to be suitably buried or burned up, on the premises owned or occupied by such person.

SEC. 2. If the owner of any swine or other domestic animals dying from cholera or other disease, or any other person shall sell or dispose of the carcass of such swine or other domestic animals, to any person for the purpose of manufacturing the same into soap or rendering the same into lard, or for other purposes, or if any person shall buy, or otherwise obtain the carcass of any swine or other domestic animals, dying from cholera or other disease for manufacturing purposes as aforesaid, or any other purpose except that of burial or burning, as provided in the preceding section, every such person shall upon conviction be fined in any sum not less than twenty-five dollars nor more than one hundred dollars, or be imprisoned not exceeding six months.

SEC. 3. Whereas an emergency exists, this act shall be in force and take effect from and after its passage.

Approved, March 4, 1885.

These laws, although not sufficiently explicit, touch upon the most important points, and are great strides in the right direction. We would suggest laws embodying the three heads in their entirety as given above under *a*, *b*, and *c*, together with directions for their proper execution. The disease spreading so easily and rapidly requires great promptness of action and quite different rules from those which must be adopted in the suppression of glanders or tuberculosis, for example. The difference is due to the nature of the specific microbe so unlike those causing the two diseases mentioned.

It is not strange that so little attention has been paid to the restriction of this disease in the past, since legislators and boards of health and State veterinarians have had no scientific basis upon which to frame laws. Even now efforts are being made in various quarters to controvert or openly deny the accuracy of the investigations and results obtained by the Bureau, and throw the whole subject back into the chaos in which it was but a few years ago. This must have anything but a salutary effect upon those intrusted with the framing and execution of specific laws for the protection of domesticated animals.

Having thus far dwelt upon the means which must be resorted to to prevent the spread of the disease from one place to another, it becomes necessary to consider some of the measures that should be employed in checking it after it has once taken foothold in a herd. But how are we to recognize the disease? To answer this question it may be well to recapitulate briefly some of the more important features of the malady in as simple language as possible.

It is quite common for the disease to announce itself by a few sudden deaths. The stricken animals may seem well a day, perhaps only a few hours, before death. In order to remove any doubts as to the precise nature of the disease it is best to examine one or more of the animals before burying or burning them. This should be done in a secluded place which pigs can not reach and the ground thoroughly disinfected as will be described later. The disease in the sudden cases can be easily recognized. The spleen is as a rule very black and enlarged. Spots of blood from the size of a pin's head to a quarter inch or more will be seen in the fat under the skin on the intes-

tines, lungs, heart, and kidneys. The lymphatic glands are purplish instead of a pale pink. When the large intestines are opened they are found covered with these dark spots of blood more or less uniformly and entirely. Often the contents are covered with clotted blood. Any or all of these may be considered as signs of the disease in its most virulent form. In many outbreaks the early cases do not succumb so rapidly. They grow weaker, lie down much of the time, eat but little, and usually have diarrhea. Most of such cases may linger for weeks, meanwhile scattering the poison in the discharges. The disease may be recognized in these cases as soon as they are observed to act suspiciously, and there should be no delay in determining at once the nature of the disease. When the animal has been opened the large intestine should be carefully slit up and examined, beginning with the blind or upper end. There will be seen roundish, yellow or blackish spots, having an irregular depressed, sometimes elevated surface. These spots are ulcers and correspond to dead portions of the mucous membrane, and they are frequently seen from the outside as soon as the animal is opened. Sometimes the membrane has been entirely destroyed.

In order to comprehend fully the reasons for the preventive measures suggested, let us briefly trace the various ways in which hog cholera bacteria may pass from a diseased or dead animal to a healthy one.

Pigs may become directly infected by feeding on the carcasses of such as have died of the disease, or by feeding on the feces and urine of sick animals; or they may become indirectly infected by feeding upon material in which hog cholera bacteria are accidentally present and in which they have multiplied. This would include milk, water, and perhaps most vegetables in a boiled condition. It has been pointed out in preceding pages that hog cholera bacteria multiply very abundantly in milk, especially in warm weather; that they remain alive in water for months, and that they multiply upon boiled potato. It has also been shown by an extended series of experiments that they may remain alive in the soil for from one to four months. The sources of infection are thus numerous enough. It has likewise been demonstrated that these disease germs will resist drying for several months. Hence dried discharges of the sick, or the dried bodies of dead animals, are still infectious.

The channel of infection is, in most cases, the food and drink.

This has been frequently demonstrated and emphasized in foregoing reports.

The food, after leaving the stomach, passes in a liquid condition through the small intestine, so that this never seems filled; in fact, its only contents is a coating of semi-liquid matter over the mucous membrane. It passes through the small intestine quite rapidly, but on reaching the large intestine the undigested remains become more consistent, because the liquid is re-absorbed and is kept here for some time. The bacteria, if not destroyed by the gastric juice, pass quickly through the small intestine, but in the large intestine they begin to multiply and attack the mucous membrane, which they destroy. Thus the feces or discharges of diseased pigs, wherever deposited, scatter larger or smaller quantities of the virus in this way, completing the circle of infection.

In order to prevent the remaining healthy animals in an infected herd from taking the disease, the following measures are suggested

as of importance, some or all of which may be carried out according to circumstances:

- (a) Removal of still healthy animals to inclosed uninfected ground or pens as far as possible from infected localities.
- (b) Destruction of all diseased animals.
- (c) Careful burial or burning of carcasses.
- (d) Repeated thorough disinfection of the infected premises.
- (e) Great cleanliness, both as to surroundings and as regards the food, to prevent its becoming infected.

(a) The importance of this measure need not be insisted upon after what has been stated of the various ways in which pigs may be infected. The distance to which they may be removed will, of course, depend on circumstances. They should be kept so far away that there can be no means of communication either by direct contact, by drainage of the surface of the soil, or by gusts of wind. They should not be kept too closely confined, for if the disease should have attacked one or more, and not manifested itself before removal, the infection would become general. Even after this precaution is taken, latent disease among such as are apparently healthy may infect the new grounds and the remaining healthy animals. This danger is increased by the fact that not unfrequently a number of animals become infected from the same source at the same time. Some will show symptoms very speedily; in others the disease will remain latent for a longer time. Under such circumstances it is impossible to properly isolate the well from the sick. Then there is the difficulty of preventing the healthy animals from carrying the virus on the skin and feet into their new quarters. These drawbacks may be in part overcome by very prompt action when the first signs of disease appear in a herd, before the virus has had an opportunity of being scattered about. The bodies of those to be removed may be fairly well disinfected by pouring over them a 2 per cent. solution of carbolic acid, and forcing them to walk through such a solution.

(b) This measure is recommended to prevent the further spread of the virus by the diseased animals. In view of the fact that few recover; that even these few are stunted and of little value; that there is no reliable means of treatment which will eventually cure, destruction of all sick animals is the simplest and most economical procedure in the end.

(c) The disposal of carcasses has already been discussed. This very important measure should never be lost sight of.

(d) Among the various disinfectants which can be recommended are the following:

No. 1. Slaked or unslaked lime, used both as a powder and as slaked lime containing about 5 to 10 per cent. of dry lime (from one-half to 1 pound of lime to a gallon of water).

No. 2. Crude carbolic acid, prepared by adding to the crude carbolic acid, obtainable from druggists at about 90 cents a gallon, an equal quantity of ordinary sulphuric acid. This mixture is to be carefully added to water in the proportion of 2 ounces to 1 gallon of water (about $1\frac{1}{4}$ per cent. by volume).

No. 3. A 1 per cent. solution (by volume) of ordinary sulphuric acid ($1\frac{1}{4}$ ounces of the acid to 1 gallon of water).

No. 4. A 2 per cent. solution of carbolic acid. This is prepared by heating the crystals slightly until they melt and adding the resulting liquid to hot water, in the proportion of $1\frac{1}{4}$ ounces to half a gallon of water. (A pound of carbolic acid, crystallized, retails at 55 cents.)

No. 5. Boiling water.

The careful laboratory experiments with these disinfectants, upon which their practical application is based, are given in the bulletin

on hog cholera. We shall confine ourselves in this place to a description of their employment.

Disinfectants are substances which, in solutions of a certain strength, are capable of destroying disease germs. Consequently they should be applied wherever the disease germs are supposed to be. In case of hog cholera they are attached to the sides and floorings of pens, and to the various utensils used in cleaning them. They are mixed with the earth over which the diseased animals have run, or in the water which they have frequented. In the report of the Department for 1886 the use of mercuric chloride (corrosive sublimate) was recommended, as it is a powerful disinfectant. Since that time other disinfectants have been tested which are equally cheap and easily procurable. The main objection to mercuric chloride is its extremely poisonous character, which makes it undesirable to deal with it. This substance has therefore been thrown out, in spite of its powerful germicide properties, from our list of available disinfectants.

The wood-work of pens, fences, flooring, etc., is best disinfected by using upon it, with a broom, solution No. 2, until thoroughly wet. In preparing this solution it should be stated that the mixing must be done in a glass bottle or jar, and the mixture poured slowly into the proper amount of water in a wooden pail. This should be rinsed out after using to prevent the acid from slowly destroying the iron hoops.

Whenever No. 2 is not obtainable No. 3 may be used in its place, which seems to be equally efficient.

Lime is a very efficient disinfectant for hog cholera. Experiments have shown that a solution containing only .02 per cent. will destroy the bacteria. When much organic matter is present, as much as .5 per cent. to 1 per cent. may be necessary. We recommend the proportions given under No. 1, which give from ten to twenty times the strength required. The resulting liquid is not too thick to be easily manipulated. It may be used on wood-work as a whitewash, and it may be spread as a thin layer over the soil which has been infected.

The 2 per cent. solution of pure carbolic acid should be used whenever No. 2 may act injuriously by virtue of the sulphuric acid which it contains.

In general we recommend the use of No. 2 or No. 3 as often as it may seem necessary. It should be dashed upon the infected pens, troughs, tools, and over the infected soil. When there is no objection to lime this may be used on the soil, as it is equally efficient. The discharges should be covered with powdered or slaked lime, and this should be thrown in abundance into pools, or wherever water stagnates. In the case of troughs for feed, iron tools, etc., which are liable to injury, the disinfectant should be washed away with boiling water if this is at hand. Boiling water will destroy hog cholera germs by simple contact, and the disinfection will thus be made more complete. Shoes may be disinfected by rubbing them with solution No. 4.

It must be carefully borne in mind that no manure from sick pigs should be removed until it has been treated with disinfectants. The cleaning must be done after disinfection and not before, to prevent the dissemination of living virus.

The agency of mice and rats in transporting virus will depend upon the promptness and thoroughness with which disinfection and cleanliness are practiced. Mice are more dangerous than rats, in so far as

they may take the disease by feeding. Flies can only carry such small quantities of the virus that they are not likely to prove dangerous if disinfection and cleaning of feed troughs is attended to.

If these measures are carefully carried out the disease may either be checked or else mild cases only will appear, owing to the small quantity of poison which the animals are likely to consume with the food.

The epizootic may be terminated by the destruction of most of the herd. This unfortunately is usually the case. What precautions must be taken to prevent subsequent outbreaks?

If only a few animals remain it is best to slaughter them, as they are likely to suffer with the disease in a mild form and continue to infect the premises. If no more animals remain, there should be a final thorough disinfection and subsequent cleaning of the whole exposed territory, including every nook or corner where the disease has existed. This should be done with solution No. 2 or No. 3, as directed, used as freely as possible. After one or two days the ground may be covered with a thin layer, one-eighth inch or more, of slaked lime in the strength above given and left undisturbed. If there is no objection to whitewash this may be applied to infected wood-work as an additional safeguard. Even after this thorough treatment it is best not to place any fresh pigs on the premises for at least four months after the final disinfection. When animals still remain that have been exposed and have not taken the disease, no fresh animals should be introduced for at least six months after the termination of the outbreak. The disinfection must have been equally thorough.

There are often conditions which make it necessary in certain kinds of business to immediately introduce fresh pigs upon a place which has been infected with hog cholera. In such cases, the destruction of all remaining animals and the thorough disinfection of the premises are the only things to be relied upon to prevent a fresh outbreak.

After all this trouble has been taken, there is still remaining the danger of a fresh introduction of the disease, and we would therefore again call attention to the rules for prevention which are given above. These, after all, must be considered as most important. It is much easier to keep the disease away than to eradicate it after it has been introduced, without great loss of time and money. We would also suggest that in those regions where the danger from hog cholera epizootics is always present, the methods of keeping hogs be simplified in such a way that disinfection may be practiced without too much labor and uncertainty as to the results. It is only necessary to visit a few farms to be convinced of the difficulty that may be met with in endeavoring to eradicate the disease. The hogs are allowed to stray into the most out-of-the-way places when sick, instead of being kept in inclosures of definite form and size, which are readily accessible. The poison is thus scattered in such a way as to make disinfection impossible. It is certainly not necessary in raising pigs to allow them to stray into arbors, behind hedges, hide themselves under barns and out-houses. In some farms which we have visited, and which were said to be affected with hog diseases most of the year, there seemed to be no places about the house or garden where pigs did not go. Under such circumstances disinfection is quite impossible. The pens and other wooden structures, fences, etc., are also apt to be in a very dilapidated condition, so that cleaning is very much complicated. Even under such circumstances the germs will finally perish without disinfection if enough

time be given, since they gradually die in the soil and water, as our experiments have shown. A period of from six to nine months after all animals have been removed will be, in general, sufficient to purify the soil of these disease germs. In fact, the natural spontaneous disinfection is very likely accomplished in many cases in from three to four months, but it would not be safe to rely upon this.

TREATMENT OF HOG CHOLERA.

Upon this subject very little should be said, for the reason that diseased animals are a source of poison and a menace to healthy animals, and should be destroyed. Moreover, treatment is exceedingly unsatisfactory, as the disease either terminates fatally, whatever remedies are used, or makes the animal useless if it should recover. We therefore urgently recommend slaughter of the sick and thorough disinfection as the safest and most economical treatment in the end.

Treatment, however, is resorted to by a large number of owners of swine. The number of specifics, so called, which are being advertised is legion. We have tried some of the best recommended and found them of no avail. Nor is there any "specific" known in the range of veterinary or human medicine that will cure diphtheritic and ulcerative disease of the large bowels except time, combined with careful dieting, rest, and a few palliatives to relieve pain. It is impossible to carry out this treatment on swine. The success frequently reported with specifics in hog cholera is very probably due to the fact that the treatment is usually adopted when the acute outbreak is over and the plague has assumed a chronic character. The affected swine linger for a time with very slight symptoms of disease, and this change is credited to the "specific" employed.

Remembering that the severest injury is done to the walls of the large intestines in this disease, we regarded it important to determine what medicine would give a prompt and copious evacuation of the bowels in the very beginning of the disease. Various medicines were tried by Dr. Kilborne, at the Experiment Station, among others the following:

(1) *Calomel and jalap*.—February 20, 1888, to No. 463, 30 grains calomel; No. 467, 23 grains jalap; No. 468, 30 grains each of calomel and jalap. February 21, same dose given again to Nos. 463 and 468. No result.

(2) *Calomel*.—March 7, to Nos. 441 and 442, each 1 dram of dry calomel. March 8, to 441, same dose mixed with castor-oil; to 442, about 1½ drams with castor-oil.

Result: No. 441 was freely purged after second dose, continuing for twenty to twenty-three hours. No. 442 was freely purged after sixteen hours, continuing sixteen to twenty hours, when it died. At autopsy were found intense inflammation of stomach; superficial necrosis of the mucosa of large intestine, with deep reddening resembling hog cholera. No bacteria found in cultures from spleen. This inflammation was no doubt due to the calomel.

(3) *Calomel*.—March 8, Nos. 463 and 468 received each 1 dram of calomel in 2 drams of castor-oil. No. 468 was purged freely in twenty hours, continuing thirty-six hours. No. 463 was purged in sixteen hours, and made ill for several days.

(4) *Epsom salts*.—Nos. 403 and 405 (weight, 50 pounds) received each 1 ounce. Bowels slightly relaxed for one or two passages. Nos. 339 and 377 (weight, 50 pounds) received each 2 ounces in water. No. 339 was purged and made slightly ill. No effect on 377.

(5) *Barbadoes aloes*.—Nos. 402 and 404 (weight, 50 pounds) received half a dram each. No effect. Nos. 372 and 380 (weight, 65 pounds) received each 2 drams, mixed in molasses. No effect. The same animals, five days later, received each 4 drams with molasses. No effect, except discoloration of feces.

(6) *Castor oil and turpentine*.—Nos. 387 and 388 (weight, 50 to 60 pounds) received each 1½ ounces castor-oil and one-sixth ounce turpentine. No effect. No. 387 received, five days later, 2½ ounces oil and one-sixth ounce turpentine. No. 388 received, five days later, 2½ ounces oil and one-third ounce turpentine. No effect.

(7) *Linseed oil and turpentine*.—Nos. 383 and 399 (weight, 50 to 60 pounds) received each 2½ ounces oil and one-sixth ounce turpentine. No effect. No. 383 received, five days later, 4 ounces oil and one-sixth ounce turpentine. No. 399 received, five days later, 4 ounces oil and one-third ounce turpentine. Both were made sick for a day or two. No catharsis.

These trials show how difficult it is to cause movement of the large bowels in swine, and they also suggest that this very sluggishness may make them susceptible to inflammation and ulcerations such as we find in hog cholera and frequently in swine plague.

It was our intention to obtain a cathartic which would freely purge without causing any inflammation or irritation of the large intestine. Of those tried, calomel is the only available one. This must be carefully given, as it may produce the very inflammation which it is designed to check, and destroy life, as was actually done in the second experiment.

Concerning calomel, Ellenberger * says:

Calomel (in combination with castor-oil) is especially serviceable with swine; with larger animals when the contents of the intestinal canal are to be disinfected and in inflammatory fevers. It should be given to ruminants with the greatest caution.

It was our purpose to try calomel after having made these trials upon healthy animals, when the disease died out at the Experiment Station and further investigations had to be postponed.

If the large intestine has been promptly evacuated the next important step is to give only that food which leaves but little irritating waste to pass into the large bowel, such as milk and gruels. In short, it is best to use only boiled or scalded food so as to help the process of digestion as much as possible. It may be necessary to repeat the dose of calomel after a few days. As to this mode of treatment our experience is not sufficient to warrant any positive statements, and it is simply suggested to those who wish to run the risk of treating this disease.

There is another line of preventive and curative treatment which may prove valuable in the future, namely, the feeding of substances with the daily food which, while not injurious to the animal itself, may keep in check the multiplication of the virus in the intestine by an antiseptic action. It is very important, however, to bear in mind that a large number of those medicines which act as disinfectants and antiseptics are likewise injurious or even poisonous to the animal itself. A too abundant feeding of such material, while it may reduce the mortality and lessen the severity of the disease in the sick, is liable to cause injury to liver, kidneys, and other vital organs whereby the nutrition of the animal may be permanently injured. Such medicines, when carelessly given to healthy animals as preventives, may irritate the large bowel sufficiently to reduce its vitality and power of resistance when the disease actually appears. The proper medicine to feed must therefore be selected with care, and we trust that experiments to this effect may be carried on at the Experiment Station at an early date.

There is another line of treatment which demands attention, namely, the introduction of a sufficient amount of some disinfectant into the body to be absorbed, and thus to make the whole body oppose the multiplication of bacteria. Koch tried this method by injecting mercuric chloride into guinea-pigs and afterwards inoculating them with anthrax bacilli. The animals all took the disease and died.

At the laboratory of the Bureau mercuric iodide, a still more pow-

* *Lehrbuch d. allgemeinen Therapie d. Haussäugethiere*, 1885, p. 656.

erful disinfectant, was tried upon rabbits. A solution was prepared containing .001 gram mercuric iodide and .002 gram potassic iodide in a cubic centimeter. Of this .5 cubic centimeter was injected beneath the skin of the back of four rabbits (Nos. 1, 2, 3, and 4) for eight successive days. On the third day Nos. 1, 2, and 3, and a fresh rabbit (check), No. 5, received hypodermically into the inner surface of the thigh $\frac{1}{4}$ cubic centimeter of liquid containing .000001 cubic centimeter of a beef-infusion culture of hog cholera bacteria one day old. All the inoculated rabbits died, the dates being given in the appended table. Rabbit No. 4, which had received the iodide only, to observe any poisonous effect, remained well. The lesions were those of hog cholera and the specific bacteria were present in the spleen. The total amount of the iodide given was .004 gram, about one-sixteenth grain.

Rabbit No. (weighing each about 2 pounds)—	.0005 gram mercuric iodide daily.	Inoculated with .000001 c. c. liquid culture hog cholera bacteria.	Remarks.
1	June 22 to 29, inclusive ...	June 24	Died June 30.
2	.....do .....	.....do	Died July 3.
3	.....do .....	.....do	Died July 6.
4	.....do .....	.....do	
5	.....do	June 24	Died July 3.

At the same time healthy pigs were fed with the same substance in minute doses to observe any toxic effect that might appear. These experiments were likewise interrupted in their application by the disappearance of the disease at the beginning of the year. While we therefore recommend, in general, the use of a purgative, such as calomel, in the beginning of the disease, and careful feeding subsequently, we have as yet no actual experimental evidence that such treatment will be of any avail, owing to the frequent interruptions of the work.

HOG CHOLERA IN OTHER COUNTRIES.

SWEDEN AND DENMARK.

In the fall of 1887 a disease closely resembling hog cholera appeared in Sweden among swine, which rapidly spread from place to place, showing itself very fatal, and causing alarm and consternation among the agricultural population. The disease invaded the territory of Denmark, where stringent measures were adopted to prevent its further spread. The following communication, received by the Department of State from our consul at Copenhagen and kindly forwarded, may serve to illustrate the measures employed by the authorities to check the epizootic. After giving briefly the symptoms of the disease and the lesions caused thereby, Mr. H. B. Ryder continues as follows:

The very prompt and stringent measures taken by the Danish Government, it is to be hoped, will be the means of localizing as well as of effectually stamping out this malignant pest. For example, circulars have been sent from the home department to all the sheriffs throughout the Kingdom, instructing them to make publicly known that all persons who, within the last two months, may have purchased hogs or young pigs from Copenhagen or in its vicinity should immediately

give notice thereof so that their entire herds might be submitted to veterinary inspection. Furthermore, an ordinance has been issued strictly prohibiting all transport of live hogs or young pigs from one district to the other, and that no removal of the animals shall be made from their present dwellings, excepting by special permission for the purpose of immediate slaughter; and lastly, power has been given to all the police authorities, on any suspicion of disease, to order the immediate slaughter of the animals, and a *post mortem* examination of the carcass to be made by the veterinary officials; and on the appearance of the disease in any locality under their jurisdiction to order the immediate slaughter of a part or the entire herd as may be deemed necessary.

It is thus to be hoped that by these measures further spread of the disease may be arrested. It is, however, much to be feared that, in addition to the losses entailed upon the Kingdom in the destruction of animals in the course of the disease, the sorely-tried farmers in these days of agricultural depression will also be subjected to material loss in a diminished sale to foreign countries of their swine products. An order has already been issued by the German Federal Council prohibiting all importation into the German Empire of swine, pork, and sausages from Sweden, Norway, and Denmark, which will be most seriously felt by the agricultural interests, as the exports of live hogs and young pigs are almost entirely directed to Germany, whilst the exports of pork and hams are mainly forwarded to Great Britain, as will be seen by the following tables, namely:

Live hogs and pigs to—	1881-'85.*	1885.*	Pork and hams to—	1881-'85.*	1885.*
Germany head..	276, 166	192, 273	Great Britain... pounds..	12, 550, 000	20, 240, 000
Norway do....	6, 844	4, 704	Germany do....	2, 930, 000	7, 180, 000
Great Britain do....	2, 895	128	Sweden do....	3, 970, 000	3, 030, 000
Holland do....	1, 243	.....	Norway do....	1, 200, 000	700, 000

* Average.

From the foregoing figures full evidence is afforded that whilst the exports of live stock have met with considerable decline in the latter years, a great increase has taken place in the exports of swine products, due to the large number of slaughter and salting establishments which have been erected in this country for the development of the pork, bacon, and ham trade with England, and thus the loss to the agricultural interests it is to be hoped will not be quite so severely felt as would have been the case in former years under similar unfortunate conditions, and it is scarcely to be feared that England will likewise place obstacles in the way of the free imports of the products into her ports; for inasmuch as the imports of swine into Great Britain from this country have for some time only been admitted in slaughtered condition, and setting apart the facts that swine in mature stage for slaughter are far less exposed to this disease than young pigs, there will be found at the same time, under the close inspection which has been introduced throughout the Kingdom, and the energetic steps taken by the authorities in all cases of suspicion, an almost certain probability that no pork from a diseased animal can possibly be exported. The sale of swine products for home consumption plays likewise a very important part; and it is here again to be feared that restricted sales will be sensibly felt until the temporary scare in partaking of swine flesh has had time to subside.

In order that the energetic measures taken by the Government for the stamping out of the plague may be crowned with full success it will be necessary that the agriculturists should give at the same time a loyal support to the issued instructions, and work hand in hand with the authorities. He who may delay in reporting or may attempt to conceal any disease or suspicion of disease that may show itself at his place will simply be committing a crime against the class to which he belongs; and honesty in this as well as in other cases will be found the best policy; for whereas he who reports the breaking out of disease amongst his flock will receive two-thirds of the value of the slaughtered diseased animals, and full compensation for the slaughtered sound ones, the dishonest party will incur not only risk of confiscation of the diseased meat offered by him for sale, but will also render himself liable to heavy fines. The closing of Germany to the importation of these products undoubtedly can not fail to entail severe loss upon the agricultural classes; but if success can only attend the stringent measures adopted for preventing the further spread of the disease, it must be hoped the prohibition will be of short duration, and that agricultural interests will soon recover from the blow; but should the devastating plague on the other hand spread over the whole Kingdom, it will

be nothing short of a national calamity, the destructive effects of which will long be felt, as will easily be understood from the following table of the number of hogs and young pigs to be found in the Kingdom under census of 1881, viz :

	Hogs.	Young pigs.
In the islands .....head..	285, 317	392, 884
In Jutland .....do.....	242, 100	334, 707
Total .....do.....	527, 417	727, 591

Great responsibility will thus rest not only upon the veterinary and police authorities, but also upon the agriculturists, in devoting all possible energy in their mutual exertions to prevent the further spread of this dreaded evil.

The disease is supposed to have been introduced into Sweden by boars imported from England for breeding purposes. Thence it was carried to Denmark,* in which country it first appeared on the dumping grounds near Copenhagen, on which numbers of swilled pigs were kept.

Chiefly young pigs up to the age of four months were attacked, the period of incubation lasting from five to twenty days. The infected animals refused food and were at first constipated. Later on diarrhea set in, characterized by the discharge of yellow putrid masses, frequently mixed with blood. The temperature often rose to 105° and 107.5° F. The animals were indifferent to surroundings. Tail and head drooping. Conjunctiva reddened, frequently glued together with dried-up mucus. Respiration in many cases quickened and labored. Occasionally a muco-purulent discharge from the nose. Not infrequently reddening in patches was observed on the ears, snout, abdomen, about the anus and inner sides of thighs. The animals became very weak ; posterior part of body swayed in moving about. They concealed themselves in the bedding, and finally were unable to rise. Death followed insensibility and convulsions.

A characteristic sign of this plague were diphtheritic changes on the apex, sides, and under surface of the tongue, as well as on the mucous membrane of the cheeks, hard and soft palate, and the tonsils. On these parts grayish-white or yellowish opaque patches appeared, which were sharply defined, and were converted later into ulcers by removal of the slough.

In one herd the teats of several sows were affected with dark-gray, sloughing sores, with inflammation of the udders. These were infected from the diphtheritic sores in the mouths of the sucking pigs. In Denmark the disease was first recognized in this way. The acute disease lasted from five to eight days, but sometimes death occurred sooner than this.

The disease appeared in Denmark in September. In December the plague took on a more chronic character and became less infectious. The infected animals frequently showed no indications of disease, only they were smaller and thinner than others of the same age. There was occasionally coughing and diarrhea. Some recovered; others perished by a gradual wasting away. The *post mortem* appearances were very characteristic. The large intestine was attacked in every animal, and in acute cases the small intestine and stomach likewise were reddened and swollen, and the surface in part covered with a thin layer of a grayish-white or grayish-yellow soft mass, which consisted of fibrin. This same layer was very thick in the large intestine, easily lifted away *in toto* in some places; in others the attachment was firmer (diphtheritic). In other acute cases there was simply reddening and swelling of the mucosa of stomach and small intestine, and diphtheritic changes in the large intestine, the fibrinous exudate being absent. Moreover, the follicles, Peyer's patches, and mesenteric glands were always tumefied.

The seat of the diphtheritic process was the whole large intestine, more especially the cæcum. The follicles and Peyer's patches were nearly always affected. The ulcers appeared when the slough had come away. In the place of the follicles button-like sloughs were formed, which gradually invaded the whole thickness of the wall, spread laterally, and ran together into larger patches. The wall, thus converted into a cheesy mass, was frequently one-fifth to two-fifths of an inch thick, on the

* Schütz: *Die Schweinepest in Dänemark*, Arch. f. wiss. u. prakt. Thierheilkunde, XIV, 1888, p. 376.

surface irregular, colored yellow, brown, or green. Hemorrhage, due to the ulceration, was observed in one case.

In many animals the lungs were healthy. In some a muco-purulent catarrh of the bronchi was present, which caused atelectasis in one or more places with young and weak animals. Usually the ventral and anterior lobes were affected. In the diseased lobes homogeneous, cheesy masses appeared later, sometimes as large as a walnut. These masses led subsequently to inflammation and adhesion of the pleura to chest wall, pericardium, etc. The spleen was not changed as a rule. In a few cases only it was somewhat enlarged, soft, dark red.

When we compare these lesions with those found in our country we observe the absence of hemorrhagic lesions and enlargement of the spleen and the presence of more marked exudative and diphtheritic changes in the large intestine. In numerous sections of ulcerative changes we have not observed any relation between these and the follicles. The lung lesions correspond closely. Whether they are due to the disease or not must be left undecided. We have frequently seen caseous changes in the lungs of animals free from infection, and they are, perhaps, due to collapse, broncho-pneumonia, and subsequent interference of the circulation rather than to the direct action of bacteria.

The specific bacteria which are the cause of the swine disease are described briefly by Selander,* and according to his description they closely resemble hog cholera bacteria in form, motility, growth in gelatine, and appearance in tissues. Their growth on potato is said to resemble that of the bacilli of typhoid fever in man, and thus to differ from hog cholera bacilli.† Their effects on the lower animals correspond also, although the descriptions are too brief for careful comparison. There is no mention of the coagulation-necrosis, found constantly in the liver of rabbits inoculated with American hog cholera.

In the beginning of the present year (1888), Dr. John Lundgren, professor of veterinary medicine in the University of Stockholm, was sent by the Swedish Government to study swine diseases in this country. He spent several weeks in the laboratory of the Bureau, studying the bacilli of hog cholera. A culture of the swine pest bacilli from the Swedish epizootic was at that time subjected to a careful examination.

In gelatine the swine pest germ grows in general like hog cholera bacilli. On the surface of the gelatine the growth is very thin, translucent, of a pearly luster, and spreads more rapidly than the hog cholera growth. On *agar-agar* the growth is more abundant and more rapid. Beef infusion, with or without peptone, is converted into a very turbid liquid within twenty-four hours at 95° F., while hog cholera cultures are barely opalescent at that time, and remain so. Two mice were inoculated from an *agar-agar* culture of the Swedish germ under the skin of the back. Both were slightly ill next day. On the second day one was found dead. The cultures from it remained sterile. It probably died from some other cause. The second mouse remained well. On a rabbit the effect was equally negative. No rabbit survives inoculation with hog cholera bacteria.

The effect of both germs on pigs was next tried. Two Erlenmeyer flasks, containing each about 300 cubic centimeters (two-fifths pint) of sterile bouillon, were inoculated, one with the American, the other

* *Centralblatt f. Bakteriologie*, etc., 1888, i, 362.

† The chemical reaction of the potato surface, which varies considerably, frequently determines the nature of the growth. Cultures of hog cholera bacilli on potato, scarcely visible, may be made very vigorous by making the potato alkaline.

with the Swedish germ, and placed in the thermostat at 95° F. On the following day both flasks were clouded; the Swedish culture was covered by an iridescent, very thin membrane. A comparative microscopic examination showed the Swedish bacteria to be nearly twice as large as the American; their movement was far less active than that of the latter.

On the same day two pigs, starved for about twenty-four hours, were fed with these cultures by drenching, *i. e.*, the liquid was poured into the mouth so that none was lost. The pig fed with the Swedish culture showed no signs of disease at any time after. The other pig, on the fourth day, had a very liquid diarrhea, and was found dead the next morning. On examination, the spleen was found gorged with blood, but only slightly enlarged. Mesenteric glands enlarged and reddened. Stomach and ileum intensely inflamed (enteritis); grayish masses (diphtheritic) attached in patches. The ileum was invaginated and projected for 2½ inches into the cæcum; mucosa of this portion necrosed; walls infiltrated, thickened, and ecchymosed. In the cæcum the mucosa was covered by a very thin slough. In the colon the membrane was deeply reddened, covered by a catarrhal exudate and dotted with numerous very minute ulcers. Heart and lungs normal. Roll cultures in gelatine, as well as liquid cultures from the spleen, contained only hog cholera bacteria. The invagination was very likely the result of the violent inflammation.

These comparative experiments show that the two germs, though very much alike in appearance, were quite different with reference to their pathogenic effect. Professor Lundgren was inclined to the opinion that he had taken the wrong culture on leaving his native country. It may also not be improbable that this was the true germ attenuated on the way hither. As no communication has been received from him since his visit here, the question must remain an open one.

FRANCE.

During the summer of 1887 a disease was introduced into the vicinity of Marseilles by swine from Africa, which developed into an epizootic of a very fatal character. It caused great losses in the south of France, and at the time scientific men were sent from Paris by the Government to investigate the cause and suggest a remedy if possible. According to Rietsch, Jobert, and Martinand * the disease is chiefly restricted to the intestinal tract, lasting from ten to twelve days after the first symptoms have appeared. Occasionally it may last but three or four days, or be prolonged to several weeks, but it is quite invariably fatal. Sometimes there is diarrhea, sometimes constipation; the fever is not constant, the cough very rarely heard. The hind limbs are weak, the walk tottering. Appetite often persists to the end. The skin may become reddened in spots, especially on the limbs and ears. Pigs over a year old are much less susceptible.

At the autopsy the lungs, liver, kidneys, and spleen are usually found unchanged, and the disease limited to the digestive tract. The stomach and the small intestine near the valve are ulcerated. Ulcers are present in the large intestine on the valve, in the cæcum and colon. They may measure 3 to 4 inches in diameter. In animals affected with a chronic form of disease there may be ulcers on the inferior surface of the tongue and on the inner aspect of the lips.

* *Compt. Rend. Acad. Sciences*, January 28, 1888.

The internal organs are free from bacteria. But from the contents of the intestine and the ulcers a motile bacillus was obtained. Mice are killed in ten days after subcutaneous inoculation with cultures of this organism. Of ten adult mice fed with cultures two died in fifteen days. Of ten young mice all died when fed, the first in thirty hours; the others in fifteen to twenty-three days. Rabbits are but slightly susceptible. A young guinea-pig fed with cultures died twenty-two days later. The intestine showed characteristic ulcers.

Dr. Rietsch very kindly sent to the Bureau a culture of the germ which he found. It was compared with the American hog cholera germ and the following characters determined:

The motile bacilli of the same form as hog cholera bacilli, but larger, grow far more abundantly and rapidly in beef infusion. A thin membrane and a copious deposit are produced in a few days, and the liquid becomes very turbid. On gelatine the colonies differ slightly from those of hog cholera. The surface colonies spread in thin iridescent patches from 2 to 5 millimeters in diameter. In tube cultures the isolated deep colonies grow to about one-third millimeter in diameter. On the surface the growth is rapid and spreads over the greater part of that which is available. The patch produced is whitish, uniform in thickness, very irregular in outline, inclosing round spaces of uncovered gelatine. In the bottom of the tube a few air bubbles appear. On potato the growth forms a glistening, pale yellow patch at the ordinary temperature.

Thus they resemble the Swedish germs very closely, differing by so much from hog cholera bacilli. A rabbit and two mice inoculated with the Marseilles germ remained well. Equally so a pig fed with 400 cubic centimeters (four-fifths pint) of a beef-infusion peptone culture.

So far as our examination of the Swedish and Marseilles cultures has gone, it has shown them identical both as regards their positive and negative characters. They differ from hog cholera bacteria enough to constitute at least a variety. But the investigations of French savants of this Marseilles epizootic differ somewhat as to the cause.

Cornil and Chantemesse* described a disease discovered among swine in the vicinity of Paris which they consider identical with the German *Schweineseuche* and our swine plague. Subsequent experiments† to determine the biological properties of the bacteria causing the disease show that they are not dealing with the true swine plague germ (certainly not as we have observed it in this country), but with one resembling more nearly hog cholera. Their researches concerning vaccination are reported to have been successful on rabbits and guinea pigs, but since that time nothing has been published concerning experiments on pigs.

While Rietsch and Jobert‡ come to the conclusion that the Marseilles disease resembles hog cholera closely, Cornil and Chantemesse regard it identical with swine plague, although the germ they describe is not identical with the swine plague germ, as studied in Germany and in the United States.§

* *Compt. Rend. Acad. Sciences*, 1887, cv, p. 1281.

† *L. c.*, 1888., cvi, p. 612.

‡ *L. c.*, p. 1096.

§ In a recent review of the reports of the Bureau of Animal Industry by Duclaux (*Annales de l'Institut Pasteur*, July, 1888) the reviewer regards this disease as identical with hog cholera, and states that Cornil and Chantemesse had at first overlooked the motility of the germ they were studying, a rather unpardonable bit of carelessness.

It is interesting, in this connection, to trace the march of infection in the south of France, as reported to the French Academy by Fouque,* as an excellent illustration of the ways by which infectious diseases may be scattered broadcast over a country :

The disease did not, as was supposed, appear in Marseilles toward the end of June, but in the month of April, and I have been able to locate three entirely distinct centers of the outbreak due to the same cause—the introduction of African swine. These three centers are : The village of Caillols, midway between Aubagne and Marseilles ; the village of Sainte Marthe, 6 kilometers northeast of Marseilles, and the herds of the Mediterranean distilleries.

(1) From the 10th to the 15th of April a breeder of Caillols received a drove of black swine from the province of Oran (Algiers). From the first week some cases of pneumonia showed themselves among the last animals. The disease gained rapidly, causing many deaths. The survivors were sold on the 4th of May following.

On the 8th of June the same piggeries were restocked, partly with African and partly with Russian swine. Towards the end of the month there were cases of pneumonia.† The Russian swine resisted less than the others. August 16 the piggery was again emptied. Finally, during September, the third attempt was made, exclusively with African swine. This also proved a failure. The survivors were sold in October.

During this time the disease reached the neighboring piggeries, stocked with a mixed Marseilles breed. The breeders of Caillols, alarmed by the ravages of an epizootic, the nature and cause of which they did not know, decided to sell out at any price. The neighboring localities, Saint Marcel, Saint Loup, San Juan-du-Désert, etc., were successively infected. Infection was spread by the sales and exchanges of sick and suspected animals, by means of transportation (carts often used in common by several establishments soiled by the dejections of the sick, and afterward used to transport healthy animals and their feed), and also by the lateral canal of Huveaune, which receives at certain points running water coming from the grounds on which the piggeries are located.

At the beginning of September all the valley of Huveaune, from Aubagne as far as Marseilles, was infected. Diseased pigs from this region we meet again in the market of Aubagne, at the fair of September 21, and which became later on the most active agents in spreading the disease in the departments.

(2) Toward the middle of the month of August the disease appeared in a piggery in Sainte Marthe, stocked exclusively with African swine. These animals came directly from Oran without coming in contact with any other of their species. Several days later one of the largest breeders in that vicinity, who for three months had not brought a single pig to his establishment, and whose piggery was at least 600 feet away from the preceding one, sustained a considerable loss, especially among the pigs of 130 to 175 pounds.

(3) Finally, on the 25th of June, sick pigs came from Oran to the piggeries of the Mediterranean distilleries. There were very soon a number of victims of pneumonia, not only in the distilleries but also in the neighborhood, where there were from 4,000 to 5,000 in a comparatively small territory. A great many of the sick died ; the others were quickly sent to different cities to be delivered to the butchers. I have traced the history of six sows which were sold from the midst of infection to Estaque, thence they passed through the commune Rove and arrived in August at Gignac, where they introduced the disease. By an odd coincidence, some sick pigs from the same locality were taken to the fair at Aubagne and bought by a breeder of Gignac.

The fair at Aubagne, on September 21, marked the most important phase in the progress of contagious pneumonia ; during the first fortnight in October there was a veritable explosion of the disease, which up to this time had been scarcely known.

The importation of the disease by animals bought at the fair of Aubagne can be traced with the greatest precision in the suburbs south and north of Marseilles, also as far as Gardanne, in the communes of Septemes, Vitrolles, Pennes, etc., to Gignac, as mentioned above, even into the neighboring departments, which continued with the others to receive consignments of Marseilles swine. It is also necessary to mention Puget, Ville et Grasse among the localities infected.

In the beginning of December, 153 swine were shipped from Marseilles to Nice ; nearly all died in a few days. From that time cases appeared among the native pigs.

*L. c., p. 670.

†The writer calls the disease infectious pneumonia for want of a better term, although Rietsch distinctly states the intestinal nature of the malady. Fouque was no doubt led astray by the early misleading notices of Cornil and Chantemesse.

On December 22, another lot of 133 pigs were shipped ; 33 were destined for Nice, and 100 for Italy. These last were sold on the 24th, in the market of Vintimille ; nearly all died very soon.

For several years Marseilles annually exported to Spain, and especially to Barcelona, a great number of pigs. Contagious pneumonia had been causing losses there for several months, even, it is said, at Majorca in the Balearic Islands. The Spanish breeders, believing the outbreak of the disease with them was attributable to the importation of French pork, obtained from the authorities the permission to impose a quarantine of six days at Port Bouc on swine from Marseilles, to begin on the 1st of the following February. This measure has not been enforced up to the present day.

From what has preceded I believe I can conclude that the epizootic of contagious pneumonia which has raged during the year 1887 in the interior of France, and which, at this time, continues its ravages there, is of African origin. It has been introduced by Algerian swine which came from the province of Oran. This disease has made 20,000 victims in several months in the province of Bouches-du-Rhone.

Pigs, and especially those from three to nine months old, are oftenest attacked ; larger pigs appear less susceptible. The Marseilles breed, English (Yorkshire and Berkshire), and the Russian swine are more susceptible than the African swine.

Two months ago about 50 pigs two to three months old, coming from Cazerès and Le Fousseret, in the arrondissement of Muret, were used to stock a farm in Gignac. These pigs, placed in the pens which had contained sick ones, and which had only been very imperfectly disinfected, remained in good health, while more than a hundred cases of contagious pneumonia appeared around them in the same piggery. Afterwards more than 2,000 Gascon swine were imported by the single commune of Gignac. Up to the present time the disease has not re-appeared. Are we here confronted by a new example of natural immunity comparable to that noticed long ago by Chauveau in Algerian sheep in regard to anthrax ?

Taking into consideration what we know now of these epizootics and enzootics of swine diseases in foreign countries, we are forced to the conclusion that the disease in Sweden, Denmark, and France is closely related to, if not identical with, hog cholera as it is found in our country.

TAPE-WORM DISEASE OF SHEEP OF THE WESTERN PLAINS.

SIR: I have the honor to submit the accompanying report, giving the results of my investigations of the tape-worm disease prevailing among sheep of the Western plains.

Though far from complete, it presents all that is certainly known of this disease and its parasite up to this date. In my investigations I have been aided and encouraged by many kind and interested ranchmen. To Mrs. Mary L. Givens, of Colorado Springs, Colo., who placed facilities and animals at my disposition, especial thanks are due. Recognition is also due to Messrs. Wilder, Noble, Pebbles, Buz-zard, Greenleaf, and Holt, of El Paso County, Colo., for kind assistance.

Hoping in the future to be able to submit a more complete report on this and other parasitic diseases, I remain,

Very respectfully,

COOPER CURTICE, D. V.S., M. D.

Hon. NORMAN J. COLMAN,

Commissioner of Agriculture.

THE TAPE-WORM DISEASE OF SHEEP.

Tape-worms in Colorado sheep were noticed by ranchmen in the early days of ranching, but did not attract the notice of veterinarians until 1883-'84, when Dr. Faville, of the Colorado State Agricultural College, first directed attention to them. (Report Veterinary Department of Colorado State Agricultural College, January, 1885.) An earlier epizootic, due to tape-worms, had been reported to Mr. Stewart, who, in the National Live-Stock Journal for September, 1875, records their presence in Missouri sheep, and from specimens at hand determined them as *Tænia plicata*. As this tænia does not occur in sheep but in horses, it is quite likely that Mr. Stewart saw *T. fimbriata*.

In a recent letter to the Department of Agriculture the late Hon. J. M. Givens reiterates an opinion formerly expressed by him in local societies of wool-growers, and published by him in Denver (Colo.) papers of 1883-'84, that these tape-worms were a cause of the larger part of the losses among sheep, and urged the necessity of a closer study of the subject in order that more might be learned of the parasite, the amount of loss it caused, and the means of preventing it. These losses had previously been attributed to a weed called "loco," which the sheep ate.

In obedience to instructions received from the Commissioner of Agriculture, the writer proceeded to Colorado in August, 1886, and began a study of the various intestinal parasites of sheep. The studies of that year were pursued, by invitation, on the ranch of

Mrs. Mary L. Givens, who, at great inconvenience to herself, did all in her power to aid me. In the spring of 1887 I again visited Colorado Springs and prosecuted other experiments, which it was hardly possible to conduct in the East.

Early in my investigations I began to recognize the fact that one tænia, which I have identified as *Tenia fimbriata*, Diesing, was the most abundant; that it was scarcely ever absent in sheep examined, and was the probable cause of most of the tape-worm disease of Western sheep. As this tænia was so constantly present, I soon directed my attention to it, and endeavored to obtain it in all of its stages, and to learn how and where it passed its entire life. I soon learned another fact, that the other species of tape-worm (*Tenia expansa*), usually abundant in lambs, was found so infrequently that I would be unable to find sufficient material for study. The methods of study were, first, observation, and, second, experimentation. The experiments have, as yet, been productive of nothing but negative results. In determining so much of the life history as has been learned, *post mortem* observations have been the most useful. Not only have animals been slaughtered on the ranch for this purpose, but advantages offered by inspections of sheep slaughtered at the shambles for consumption have been utilized. From these inspections the abundance of the parasite, the first appearance in lambs, the different stages in growth, etc., could be learned, but it soon came to be necessary to study the surroundings of the sheep—the corral, the watering places, and the range—to learn under what condition the parasite must exist while external to the sheep, *i. e.*, while passing from sheep to sheep.

The effects of the parasite on its host (the sheep) were arrived at from studies of the flocks and from observation of individuals at *post mortems*. The changes found were noted and careful attention paid to the point whether certain changes were due to parasites or another disease called “loco.” As all of the sheep examined were called “locos,” it is evident that there was here a source of error. No certain pathognomonic lesion of “loco” was learned; as all of the “locos” were infected with tæniæ, the separation of characters due to each disease was difficult. Indeed, it has seemed to me that all of the symptoms due to the parasitic disease may be ascribed to loco. The characters of the tape-worm disease are, however, well marked in lambs which have never learned to eat this weed exclusively, and thus could be studied without regard to “loco,” which, if a disease at all, belongs to yearlings and older sheep.

Experiments were undertaken with a view of infecting lambs with the parasites, while the lambs were kept from other possible sources of infection; but these were fruitless. Other experiments were entered upon with a view of removing these parasites by medicinal remedies. None of these were effective in removing the parasites from the gall ducts, and were abandoned until more could be learned of the life history of the parasite, when they could again be taken up with perhaps a better prospect of success.

The total results regarding this tænia, so far obtained, are as follows, *viz*:

The parasite persists in an adult stage in the older sheep throughout the year.

The smallest forms appear in lambs soon after the second month of their age, and may be found in sheep of any age throughout the year, excepting, possibly, the winter months.

It requires at least six months, possibly ten, to attain an adult size. The ova or embryos are continually passed from the sheep to the ground throughout the year. The life of the embryo, from the time it leaves one sheep until it is found in another, is yet undiscovered.

When present in considerable numbers in sheep it determines a disease which is not only detrimental to the value of the animal, but at times causes the death of large numbers.

No medicinal remedies can be recommended which will assuredly remove the parasite from the host.

Many measures may be taken which may prove to be effective in two ways, first, in preventing sheep from becoming infected; second, in enabling the sheep to better withstand the ravages of the parasite, and thus carry it over the critical stage of its existence.

The lambs and yearlings are the greatest sufferers, and it is to these that the most attention must be paid.

TÆNIA FIMBRIATA, Diesing.

See Plate I, Figs. 1-7, and Plate II, Figs. 1-15.

Thysanosoma actinioides, Diesing, 1834.

Med. Jahrb. d. österr. Staat. Neue Folge VII, 105-111.

Taf. III (Fig. inverse delin.) Ej. Syst. Helm. I, 501 in nota.

Tænia fimbriata, Diesing.

Syst. Helm. I, 501.

Tænia fimbriata, Diesing, 1856.

Zwanzig Arten. v. Cephalocothyleen, p. 11, 1856. Wien.

Tænia fimbriata, Diesing, was first discovered by Natterer, in Brazil, in 1824, and published by Dr. K. M. Diesing in 1834 as a new genus, *Thysanosoma actinioides*. Later, in 1856, Dr. Diesing republished this parasite as *Tænia fimbriata*. (See Plate I.)

The first specimens found were detached segments, and from these the first description was made. Natterer later found more complete specimens and upon these the species was founded. The specimens were found in the intestines of the following species of deer, viz: *Cervus paludosus*, *C. rufus*, *C. simplicornis*, *C. Nambi*, *C. dichotomus*.

A translation of the original Latin description is as follows:

Arhynchotæniæ, Rostellum none; mouth unarmed.

Tænia fimbriata, Diesing. Tab. V, Figs. 9-15. (Plate I is a copy.)

Head obtuse tetragonal, large, with hemispherical angular bothria; neck none; body anteriorly lanceolate, with very short cuneate segments; posterior margin of the upper entire, of the following crenate, of the last fimbriate on each side; the linear fimbriæ rounded at the apices. Genital apertures —; length 6"—'6"; width 1"—3". Mature segments, separate, 1" long, 2" wide, with lanceolate fimbriæ.

This description was necessarily imperfect, from the lack of abundant material, but is nevertheless sufficient to enable us to identify the present species with it. Fortunately, too, excellent figures enable us to clearly understand the fimbriate character of the species. At present this is the only species known to possess this character. Though characters founded on form are of doubtful value, until more decided differences are determined between the fimbriate tænia of deer and those of sheep, this decidedly strong character must serve to keep the two together. Besides, there are no strong reasons why the two should be separate, for each is of about the same size, a fact which we would scarcely expect in the same parasite living in hosts of different genera; and each is also found in hosts of similar body temperatures, habits of life and of feeding. That they are found in far separated localities need be no serious objection, for

the land connection of North and South America would permit of the infection of deer of both continents with the same species of parasites.

Tænia fimbriata is lanceolate when contracted, linear when relaxed. It is quite thick, the fimbriæ on the contracted specimens presenting the appearance of plush. The segments can only be distinguished on the more relaxed specimens. Adult specimens are from 15 to 30^{cm} in length, and about 8^{mm} in width. Immature specimens range from less than 5^{mm} upwards. The greatest width is about 2^{cm} from the free end, from which point the segments become narrower. There are at the free end of adult specimens from three to four or more segments which are of nearly equal width, which have lost their contractility and are in the process of being shed. The shedding of segments begins in youngest specimens and continues throughout the life of the parasite.

The head or organ of attachment is depressed and tetragonal, and quite large, sitting on the neck like a pin head; it is from 1^{mm} to 1.5^{mm} wide, hookless, and has four very large suckers. The substance of these cups forms the greater part of the head.

The neck or the part where segmentation begins is very short in contracted specimens, but can be seen in the relaxed condition. The segments are very short and flat near the head, but concave or cup-like toward the free end, each one lapping the succeeding, and all appearing linear on the surface of the tænia. The terminal relaxed segments are cuneate. The borders of segments nearest the head are slightly wavy or crenate. They soon become fimbriate even in youngest tænia; so that the smallest specimen found demonstrated the fringed character of the species. The fimbriæ may either be contracted, when they are stout and short, or relaxed when they are flaccid and proportionately longer. They are obtusely pointed. The segmentation in contracted specimens is made out with difficulty. It is indicated by transverse striæ. In relaxed specimens it is plainer.

The sexual organs are symmetrically placed, two sets in each segment, each opening in a lateral pore. Each set of organs is composed of a male and female portion, or is hermaphroditic. They begin to develop at some distance from the head and attain maturity towards the middle of the tænia.

Besides being remarkable in the fimbriate character of its segments this species is also peculiar in the form of its reproductive apparatus. The male portion develops first and occupies the whole width of the young segments. It consists of sacs connected by tubules with a large tube which finally becomes the much convoluted efferent tube.

The ovaries develop later, and are situated at each side of the segment. They are not shown in the plate.

The uteri develop last. Each is made of a series of bags arranged side by side in a fringe which extends along the top of the segment from side to side. These bags open into a larger tube from which they receive the developing embryo. The tube connects with the ovaries. The embryos develop in the uteri, and probably remain there until the segments go to pieces on the ground, and thus permit them to be scattered. They are six-hooked and not essentially different from those of other tænia.

This tænia is found in the duodenum and gall ducts of sheep. The former is sometimes found containing from thirty to one hundred specimens. More often, however, there are from two to thirty. The

gall ducts are frequently completely distended by the *tæniæ*, which pack them so tightly that the parasites can not be withdrawn by pulling without breaking. Occasionally one, or at the most two, may find their way into the pancreatic ducts, which they also distend. They get into these ducts when young and distend them as they grow larger.

A few disjointed segments may be found below the duodenum, but no entire individuals. Nearly every sheep of a flock will be infected.

DISTRIBUTION.

Tænia fimbriata, Diesing, the fringed tape-worm, is at present the most common parasite of the sheep of our Western plains, and causes by far the greatest loss of any intestinal parasite in this country.

As may be seen by inspection of the tables showing parasites found in different *post mortem* observations, it has been identified in sheep from Utah, Colorado, and Nebraska. Mr. Codweis, of Granger, Colo., a former sheep owner in New Mexico, says that he has seen them there. Mr. Samuel Collins, of Colorado Springs, Colo., who has slaughtered sheep from California, Oregon, Utah, Nebraska, and Colorado, says that all sheep from these States have them. Dr. Faville, of this Bureau, personally told me that he has seen them from Oregon sheep and from sheep in New Mexico. Mr. Stewart's identification of *Tænia plicata* from Missouri sheep (National Live Stock Journal, September, 1875), leads me to suspect its presence in that State. When to these evidences of wide-spread distribution we add those offered by the intermingling of Western sheep by parentage and traffic, and by the opportunities for infection presented by the nearly unrestricted communication of the ranges, we may believe that this distribution is necessarily wide-spread. Its distribution at present is from Oregon and Wyoming southward, and from Nebraska and Missouri westward; or more accurately from the ninety-fifth degree of west longitude westward, and from 45° north latitude southward. It coincides with the distribution of the sheep in those parts; and more especially with that of the descendants of the Mexican or Spanish sheep with which nearly all of the larger ranches were originally stocked. The precise limit of its eastern distribution is unknown, but I think is limited to those portions of Nebraska, Kansas, and Missouri to which Colorado feeders have been sent prior to selling them to the Chicago markets.

There are at present no facts at hand to show that the parasite exists east of the Mississippi River. In two instances I found a number in sheep slaughtered in Washington, D. C., but these animals were said to have come from Chicago, Ill.

LIFE HISTORY.

All of the life history of this *tænia* that is at present known has been learned from *post mortem* dissections and microscopic investigation.

The adults were found in yearlings and older sheep throughout the year. No adults have yet been found in lambs less than ten months old. The smallest stages of the immature *tænia* may be found in all young sheep over ten months old. They are usually most abundant in lambs, yearlings, and two-year olds. Although a sheep may be infected with a number of *tæniæ* of about the same size, indicating an infection covering but little space of time, it is

more usual to find the parasites of various sizes, indicating a continuous infection. The retention of food and liquids for some little time in the rumen and reticulum may account for this in part. These varying sizes continue from May until December. Sheep examined in May presented various sizes, and indicated infection in former months. No other data showing infection during winter months were obtained. The smallest tæniæ are found in the duodenum; those found in the gall ducts are larger. Tænia less than $\frac{2}{3}$ inch long have been found in the duodenum after the gall duct has become completely packed by the parasites. The adult worms have embryos in their most distant segments, which are ready to be set free. These embryos escape from the host with the feces. Until they reappear, in the duodenum of another sheep, a quarter of an inch in length, their history is unknown.

A tænia infecting a lamb two months old, the youngest stage noticed, is about a half inch long; as the season advances it is joined by others, and these increase in size. Four or five months afterward it is found to be 4 or 5 inches in length, showing a monthly rate of growth of about 1 inch. From this time it gradually increases in size until the following spring, when it becomes adult and capable of furnishing embryos for infection of other animals. These embryos escape from the sheep, and while many are destroyed a few arrive at their destination in a second animal.

PATHOLOGY.

The influence that the presence of *Tænia fimbriata* has on the life and health of its host is not inconsiderable. The ultimate loss is seen when lambs which should be fat and strong are not, and die during the colder weather while the fatter ones survive. This loss, where the hosts do not die, can not perhaps be accurately estimated, but is nevertheless present, for thin, hide-bound, dwarfed sheep are not valuable for mutton, nor do they produce as much wool as they otherwise would.

So slowly are the parasites hatched, so slowly do they grow, and so gradually do the symptoms develop, that the tæniæ are present in considerable numbers and size before systemic disturbances in the lambs present themselves. An experienced ranchman will probably notice towards September that some of the lambs are not growing as they ought. Later in the fall the symptoms increase. In November the lambs, which are by this time thoroughly infected with a number of strong, tenacious parasites, show the disease quite plainly.

The disturbances finally shown are induced at first by the local irritation produced by the worms attaching themselves to the villi of the intestinal walls and causing a greater secretion through their strong vermicular action. A continuance and increase of this irritation caused by the growth of the parasite and an accession of other parasites, finally excites chronic catarrhal inflammation of the duodenum and biliary duct. To these disturbances we must add those arising in the liver from a plugging of the duct by the parasites, which grow so large that they distend it to a comparatively large size.

Dr. George C. Faville, in a report of the veterinary department of the State Agricultural College of Colorado for 1884, describes the *post mortem* appearances of these animals as follows:

Organs of thorax were normal. In the abdominal cavity I found the stomach filled with a mass of semi-digested loco leaves. The liver was normal in appear-

ance; gall bladder filled with greenish-colored bile. In the duct, running from the gall bladder to the small intestines, I found a mass of tape-worms (*Tænia expansa*). The small intestine I found filled with a mass of these worms, varying in length from 6 inches to 5 or 6 feet. The kidneys were normal in size and color, but, upon section, I found the pelvis filled with a gelatinous material. The muscular system was exceedingly flabby and pale in color. The body seemed to be absolutely destitute of fat. The urine was normal. The brain showed a slight serous effusion about the base, and to a slightly greater extent in the region of the medulla oblongata. There also was a slight effusion into the abdominal cavity. The only other change that could be found in the brain of these sheep was a slight congestion of the arachnoid membrane.

The above description is taken from so-called "locoed" animals, but applies equally well to *tæniæ*-infected sheep. Of the many "locoed" animals that I have examined, but one or two have been free from *tæniæ*, and in these the gall ducts were thickened and enlarged as though they had at some earlier date been infected. It is extremely difficult to separate the symptoms of the two diseases, and it seems to me that many cases of "locoed" animals are victims of the tape-worm. That the *tænia* may tend to produce depraved appetites and the morbid craze for a particular food, is also a reason for suspecting that the loco disease may depend in part on the tape-worm disease.

In Dr. Faville's description there is one point to which I wish to call attention, and that is the finding of a slight congestion of the arachnoid membrane. In specimens that I have examined there seemed to be no undue congestion, and the arachnoid membrane, which is a vascular one, naturally looks red or dark colored. The brain symptoms of these animals are such as arise from anæmia rather than hyperæmia of the brain.

In affected yearlings which are not suspected of eating loco more than other animals (all eat of the loco plants), the following *ante* and *post mortem* symptoms can be observed: Lambs that are badly affected are large headed, with undersized bodies and hide-bound skins. Their gait is slightly like that of a rheumatic. They seem to have difficulty in cropping the shorter grass; they also appear to be more foolish than the other sheep, standing oftener to stamp at the sheep dogs or herder than the healthier ones. Others do not seem to see as well, or are so affected that they appreciate danger less. In driving they are to be found at the rear of the flock. Internally the organs present no marked symptoms of disease. The abdomen contains more dark-colored serous fluid than normal; the omentum is often nearly devoid of fat. The catarrhal inflammation and thickening of the mucous membrane of the duodenum and gall ducts have already been noticed. The liver, in cases of long standing, is somewhat smaller than normal; the kidneys are sometimes flabbier and paler than normal; the lymphatics look somewhat darker; the muscles are thinner and weaker. There is in all cases a diminution of fat, and in most cases the leanness of muscle is marked. In those places where the fat usually occurs in masses, little or none is found. Associated with this condition is the presence of serous infiltration of connective tissue in the abdomen, thorax, spinal and cranial cavities. This infiltration is the most marked in the worst cases. The groin, the pelvis of the kidney, the spaces between serous coats of the abdomen, and other spaces where serous membrane partially or entirely surrounds an organ, are noticeably infiltrated.

These conditions hold in lambs and older sheep. Between the worst affected and entirely healthy individuals there are many grades.

The symptoms and pathologic lesions are those of innutrition, and aside from the lesions of the duodenum and liver are not materially different from the systemic lesions caused by other parasites, or from innutritious food, or from any cause that would prevent the animals obtaining and assimilating nourishing food. A variety of other causes would produce the same lesions.

The parasites may produce their evil results as follows: Their vermicular actions cause increased secretion of the intestine where they are lodged, both by direct irritation and sympathetically, *i. e.*, the adjacent intestine secretes more than it ordinarily would by acting in sympathy with the infected portion. This hyper-secretion soon becomes abnormal, and the secreting membranes become so changed that they can no longer act physiologically. Its best purpose is in furnishing the parasite with more nutritious fluid. The plugging of the gall ducts not only stops the gall from flowing at proper times, but dams back that which is secreted during digestion, and allows it to slowly ooze out after it is needed. When the ducts are unobstructed the bladder and ducts are emptied at their proper times, and any interference with this flow deranges healthy digestion. The damming back of the gall reacts on the secretion in the smaller ducts, and this in its turn reacts on the physiological functions of the liver cells.

The disturbance of digestion due to this impairment of the functions of the liver and duodenum has not a merely local effect. In the upper parts of the small intestine important digestive changes take place, and the disturbance of any of these prevents the proper preparation of food for its assimilation through the intestinal wall, resulting in a loss to the animal of nutrient material. The duodenum is held to be a very irritable organ, diseases in it causing reflex disturbances of various kinds. These reflex actions also lead to many systemic disturbances. Now these disturbances are each slight, but when combined and continued through weeks and months they cause the results just described. To one seeing a half dozen or more worms taken from the intestine of a sheep, the worms do not seem to be a sufficient cause of disease. The disturbance caused by one worm in man gives rise to even greater systemic derangements. The non-assimilation of food and reflex irritation produced by the tape-worms seem to me to be the chief causes of the impoverished condition of the infected animals. From these causes proceed the mal-nutrition of the various organs and the dropsical effusions resulting therefrom.

From this state of mal-nutrition all of the systemic disturbances can result. The staggering gait may arise from the weakened muscular system; the absence of fat from non-deposition of more and the consumption of that heretofore deposited; the serous effusions from the weakened condition of the system; and the foolish actions from the long-continued mal-nourishment of the brain.

Sheep do not die from the tape-worm disease alone. The greatest losses are, the ranchmen say, among the lambs and yearlings. The majority may die during cold storms, either from freezing or from suffocation while piling upon each other for warmth. They may starve to death either from inability or lack of desire to eat. They may die from other diseases. The tape-worm disease appears to render them more liable to other affections and less able to withstand the inclement season. It is, therefore, indirectly chargeable with the loss. Were the infected sheep not to die, the parasite is still a cause of pe-

cuniary loss. The impoverished condition traceable to it is a small average loss for each animal, but for flocks of over 5,000 sheep aggregates thousands of dollars for each ranchman.

In the article of Dr. Faville, cited above, he quotes a letter* from the late Hon. J. M. Givens, whose flocks numbered from 6,000 to 8,000 head. In this letter Mr. Givens states his loss from dead sheep alone for the preceding year at from \$3,000 to \$4,000. Fortunately the loss of from 400 to 1,100 or more sheep does not occur to flockmasters annually, but such losses are not infrequent, and may be heard of either on this or that ranch during different years. Every ranchman knows of and appreciates the steady though small loss arising from the depreciated value of his animals, due to their ill condition from various causes, and which he strives by every means to reduce, for therein lie the profits and success of his business. From the study and observation which I have been able to devote to the tape-worm disease I think it alone is responsible for more losses than any other sheep disease on the prairies excepting scab. The direct death-rate traceable to it is large when compared to the entire death-rate, and the indirect loss traceable to it is, though more insidious in its character, still larger, for it is ever present and ever active.

MEDICINAL TREATMENT.

Some experiments looking toward the removal of *tæniæ* by medicines were made in 1886. Various *tæniæ*fuges were tried with little success. The powdered preparations of ground pumpkin seed, pomegranate-root bark, koosoo, kamala, male fern and worm seed proved of no avail.

In order that they might be administered cheaply the proper amount of each for ten animals was mixed with meal, bran, and salt, and fed in a trough. When sufficient meal and salt was mixed with the medicines to entice the sheep to eat it, the bulk that contained the requisite dose of medicine was too large for a sheep to eat at once. As this bulk was retained for some hours in the rumen the efficacy of the dose was lost, for the virtue of nearly all of these remedies depends on the dose passing through the intestines in mass. Human patients are usually prepared for the medical treatment by abstaining from food for at least twelve hours previously; they are then given a cathartic which is followed by the anthelmintic. This plan of treatment utterly fails in ruminants, for neither stage can be successfully carried out in administering these remedies by the mouth. The presence of the large rumen, which holds a large quantity of reserve food, and into which new material may be taken, accounts in part for this. Some of the food, if sufficiently fine, in fasting animals passes directly to the manifolds and fourth or true stomach, but a certain proportion would fall into the rumen and thus the efficacy of the total amount acting within a given time would be lost.

These experiments failed, therefore, through the anatomical structure of the animal and the method of administration. The presence of *tæniæ* in the biliary ducts is another reason why *tæniæ*fuges

*The letter referred to gives "loco" as a cause of the losses. Before his death the Hon. J. M. Givens had concluded and communicated to his friends of the El Paso Wool Grower's Association, that the loss of this winter was not due to "loco," for the greatest loss had occurred in young sheep and lambs. The latter had not learned to eat "loco" exclusively, were poor, and presented symptoms which he learned later belonged to sheep infested with tape-worms.

can not be entirely successful in treatment of sheep with *T. fimbriata*. Any medicine which would affect the tæniæ in these ducts would also affect the sheep seriously. It is doubtful whether they can be killed or driven from the ducts. The continued or repeated administration of remedies that are necessary for expelling these tæniæ is also an objection to their use. The parasites are continually appearing throughout the year, and even if those already developed could be driven off, the constant re-infection would necessitate other operations for their removal. The cost of the necessary medical treatment seemed to me to more than exceed the good results that possibly might be realized. Further experiments were therefore delayed until the complete life history of the parasite should be determined. In this history we may hope to find some stage at which we may more profitably administer remedies. I have seen many prescriptions for tape-worms in ruminants in various journals and agricultural papers. Some of them when tried may have proved very efficacious. Unfortunately I have been unable to find further reports concerning the effects of their administration. My own experience leads me to have little faith in them. There is a feature about them which, I have no doubt, has been recognized by the ranchman who has undertaken to carry them out to the letter, viz: It is the entire inadequacy of the receipt, in prescribing methods of administration, and medicines of reasonable price as well as of certain efficiency, which shall meet the ranchman's wants. This oversight is of such importance that otherwise good receipts have to be abandoned. The western methods of treating sheep medicinally must differ from the eastern methods, as the methods of sheep-dipping, sheep-shearing or sheep-husbandry in these sections differ; otherwise the expense of treatment will be so considerable that in view of any uncertainty of cure few ranchmen will undertake it.

PREVENTIVE TREATMENT.

The most effective service rendered to man and beast by the physician has been through the prevention of diseases and the preservation of health by hygienic measures. Appreciating this, and realizing that effective prophylactic treatment of the sheep against infection by *Tænia fimbriata* could not be realized except by the most thorough knowledge of the complete life history of the parasite, I turned my attention to the investigation of its younger stages, and those of other unarmed taeniæ which were available. Such are the difficulties of this investigation that I have not yet completed the gap in the life history which may exist between the time when the embryo passes from the sheep until it is found, less than a quarter of an inch long, in another sheep.

From the present knowledge of the development and life of this parasite there have arisen more difficulties in forming rules of prevention than I at first supposed would be the case. The presence of the adult and young parasites throughout the year, and the methods of Western sheep ranching are factors which are all-powerful in keeping up the tape-worm disease. The case is not a hopeless one, however, for there are certain phases of feeding and watering the sheep which I think can be advantageously changed, both for the prevention of this and other diseases.

The feeding occurs on the prairie and in the corral. I would recommend that the ewes with their lambs should be pastured on a

portion of the prairie that had not been run over by sheep for some months previous. They could be driven to the new pastures about the time that the lambs begin to nibble at the grass and drink water. After the lambs are weaned they should be changed to fresh, uncontaminated pastures until winter, and other and older sheep put on the range vacated. If there be sufficient range the lambs could be kept on as nearly uninfected ranges as possible until they become two-year olds. In feeding lambs on grain and hay measures should be taken to keep the food from the ground. The grain should be fed from troughs, placed either on a board floor that could be cleansed, or on ground kept scrupulously cleaned of all droppings. The hay should be fed from racks. The corrals for the lambs should either be fresh ones or the old ones should be periodically and thoroughly scraped out and cleaned. They should not be put with a greater number of old sheep than is absolutely necessary.

The watering occurs at various places. The usual method is the watering at rivulets or ponds. This should be done, but such places should be fenced in and troughs provided into which the fresh water could run. These troughs should be raised a little above the surface of the ground, so that they could receive no surface drainage. By the aid of pumps and wind-mills this could be easily accomplished. Most watering places are so situated that by conducting the water through pipes or boxes but little expense would be necessary to guide it into troughs. These troughs should be kept clean. The lambs should not be allowed to drink elsewhere, nor to eat grass in moist places unless it is absolutely certain that these places are uninfected. The location of corrals so that they either surround water or that the drainage is from them to the water seems to be a most harmful practice. It not only makes the water fouler but renders it more likely to hold parasites. Herders should be instructed neither to feed nor water at the prairie pools. If there are places where it is advisable to water they should be prepared as the watering places at the corrals. The nearer the ranchman can arrive at giving the lambs pure fresh water the less infected with parasites will they become. The salt for the lambs and young sheep should be fed from boxes placed near water places and kept constantly full. They will take no more than they want, and will be all the healthier if they have all they need. If they are deprived for a time they may at first salting eat more than is good for them. A little eaten daily is physiologically better than the larger quantity eaten at intervals. The object of feeding the salt at watering places and from boxes is to keep them from licking the dirt where salt has stood, and to keep them from eating the prairie alkali. In addition to the opportunities afforded them of being infected with parasites from the salted ground, there is the injurious effect of the swallowed sand. This sand often packs away in the gall ducts and produces disease.

It may be when the gap in the life history of *Tænia fimbriata* is known that a single measure of prevention will eradicate it from the flocks. Until then the general measures prescribed above are to be recommended.

There are various minor precautionary measures to be fulfilled that will help affected sheep to live through the colder winter, and finally to render effective service in spite of the parasite. The *post mortem* examinations have led me to expect that from 80 to 95 per cent. of each flock is infected. Now, were all of these to suffer as some of the more diseased do, sheep ranching would be at its end. Fortu-

nately a sheep may have a few parasites and not be seriously affected by them. This is shown by the fine large sheep slaughtered which are passably fat and yet contain *tæniæ*. It is a frequent remark of the ranchman that if he could carry his lambs and yearlings through that they would do well enough afterwards. It is these younger and growing animals that succumb soonest to the parasite. It is a rule that all young and growing animals are more seriously disturbed by the presence of parasites than older ones. Young lambs born in May or June have necessarily but a short time in which to grow before the cold season. When food is plenty, and there is no disturbance of their digestion, or other ailments, they enter winter strong enough to endure the weather without particular suffering. Interference with digestion, lack of food, or any ailments render the lambs so much the weaker, and consequently less able to endure the winter storms. The parasites interfere with digestion, and to overcome their evil effect means should be taken to supply easily digestible and fattening food, which may replace and add to that lost. Many ranchmen already feed their lambs extra grain during the fall, and have learned that not only are their losses diminished, but that the lambs become larger and stronger as well as fatter.

Formerly the ranchman depended, as many do still, entirely on the prairie for grass throughout the season. Of late years many are feeding more and more hay during the winter, and find that they profit by it in the diminished death rate and the improved condition of the flocks in spring. This fall and winter feeding is then to be especially recommended as a remedial measure against losses among tape-worm infested sheep. With increased prosperity, flock-masters are adding to their shedding at the home corrals. Though the first cost seems considerable, such are the evident benefits in preventing losses during the extremely cold snaps and blizzards, that not only should they be built at the home ranches, but also at the outliers, where now, with few exceptions, none are to be found.

The water afforded sheep, more especially lambs, should, if possible, be made warm during the coldest weather. The temperature of sheep is about 103° F. In giving them water which is less than 35° F. the heat which is necessary to raise the water to the temperature of the animal is withdrawn from other portions of the body, and digestion is often disturbed and less water is drank. Experiment has proven that animals fatten better on warm water, and were it practicable I would urge that no water cooler than 60° F. should be offered to sheep. The maintenance of the drinking water at this temperature, for the use of the lambs and other home stock, would, I think, repay the Western ranchman, as it certainly would the Eastern farmer. I am aware that this is impracticable at some ranches, but there are many home ranches where lambs and blooded stock are kept at which the system might be pursued with advantage.

There is another possible chance of infection which I know no means of remedying. If, as I believe may be the case, the *tænia* embryo passes with but little modification from sheep to sheep, there is then a certain amount of infection that may occur between the ewes and offspring when suckling, the lambs becoming infected with the embryo by rubbing them from the mother in nosing around while suckling. As older sheep have the *tæniæ*, and as lambs become infected after being weaned, this method of infection is only one of many.

I can recommend no medicinal remedies or preventives. The rec-

ommendations above are directed toward lessening the chances of infection and preserving the health of the animals.

It is hoped that the gaps in the life history of *Tænia fimbriata*, or others of our unarmed tæniæ, may yet be filled out. With a knowledge of this history, the methods of prevention would be evident to all.

The flock-master should take pains to examine the sheep which die and inform himself, as nearly as possible, of the cause of death. In case of the presence of tape-worms, causing sickness, he can soon inform himself of their abundance, of the absence of other disease, and of many other things. He can soon judge whether others of his flocks have them, and can more intelligently set about their treatment. A careful study of each case will then place the observant man in possession of many facts which will help him in the proper management of his flock.

The above recommendations have been written with a view of keeping the food and drink of the animals as clean as possible. Other precautions will suggest themselves to the ranchman.

POST MORTEM EXAMINATIONS.

The tables herewith presented are the results of *post mortem* examinations of sheep, some of which were killed expressly for the purposes of investigation. Others were examined while being slaughtered for food, either on ranches or at the shambles in Colorado Springs, Colo., while others were performed upon dead sheep found either at or in the vicinity of various ranches. From the widespread distribution of the disease, they are such notes as could be taken from nearly all localities, and can not be ascribed to purely local causes. Where the observations were taken from sheep raised in States other than Colorado, the State from which they came is given.

In addition to the presence of *Tænia fimbriata*, I have noted the occurrence of *Tænia expansa*, and also of *Tænia marginata*, which occurs in sheep in its cysticercal stage. The examinations at the shambles could not be conducted with the same accuracy while hunting for *Tænia fimbriata*; the occurrence of the cysticerci is therefore omitted in the *post mortem* observations of June 7, 1887, to August 15, 1887, inclusive.

Table A shows that tæniæ occur in sheep throughout the year. It also indicates a wide-spread distribution.

A.

Date.	No. sheep examined.	No. lambs examined.	Location.	<i>T. fimbriata</i> occurred in—	<i>Cysticerci</i> occurred in—	<i>T. expansa</i> occurred in—	
1886,							
Sept. 16	1	.....	Colorado	.....	1	.....	.....
18	1	.....	do	1	1	1	.....
21	1	.....	do	1	1	.....	.....
24	3	.....	do	3	1	.....	.....
27	2	.....	do	2	1	.....	.....
30	11	.....	do	9	9	.....	.....
Oct. 1	10	.....	do	9	6	.....	.....
16	5	.....	do	4	1	.....	.....
21	.....	1	do	1	.....	.....	.....
29	4	2	do	6	3	.....	.....
31	2	1	do	2	.....	.....	.....
Nov. 2	1	.....	do	1	.....	.....	.....
8	8	.....	do	8	.....	.....	.....

A.—Continued.

Date.	No. sheep examined.	No. lambs examined.	Location.	<i>T. fimbriata</i> occurred in—	<i>Cysticerci</i> occurred in—	<i>T. expansa</i> occurred in—	
1886.							
Nov. 4	5	.....	Colorado	3	.....	.....	.....
9	2	1	do	3	1	.....	.....
10	2	1	do	3	1	.....	.....
11	1	.....	do	1	1	.....	.....
15	1	.....	do	1	.....	.....	.....
16	.....	1	do	1	.....	.....	.....
19	.....	1	do	1	1	.....	.....
21	.....	2	do	2	.....	2	.....
22	10	.....	do	10	7	.....	.....
Dec. 26	.....	1	do .....	.....	1	1	105
29	.....	1	do	1	1	.....	107
30	.....	1	do	1	1	.....	109
1887.							
Jan. 8	.....	1	do	1	1	.....	108
Mar. 14	2	.....	do	2	.....	.....	103-104
20	1	.....	do	1	1	.....	101
Apr. 20	1	1	do	1	.....	.....	106
28	1	1	do	1	1	.....	102
May 7	.....	1	do	1	1	.....	110
June 7	8	.....	Nebraska.....	8*	.....	.....	.....
9	10	.....	do	10	.....	.....	.....
13	10	.....	Utah	8	.....	.....	.....
25	5	2†	Colorado	5	.....	.....	.....
July 29	4	4	do	3	.....	.....	.....
Aug. 5	.....	4	do	2	.....	.....	K. & L.
5	20	.....	do	19	.....	.....	.....
July ..	.....	1	do .....	.....	.....	.....	.....
Aug. 15	4	4‡	do	3	.....	.....	.....
Total.	136	32	.....	139	42	5	.....

* From June 7 to August 15, inclusive, cysticerci were found in most of the animals examined.

† No tæniæ found in the two lambs.

‡ No tæniæ found in lambs.

EXPERIMENTS.

November 30, 1886.—Six lambs selected from a ranch that had been kept in an inclosure since the 15th of October, were with two yearlings and two two-year-old wethers, crated and sent to the United States Veterinary Experimental Station at Washington. The lambs were from a collection of the runts of a large flock which had been fed on hay made from prairie grass and on coarse corn meal and bran before November 30. They were watered from tubs, the water being drawn from a well and a pond near by. The hay had not been crossed by sheep since spring, at least. The water was clear. The chances of infection from these sources were small. The corral where they were kept was a good warm shed, located amidst others, with a small adjoining yard. The dogs, of which there were two and sometimes more, had free access by jumping the hurdles; but I do not remember ever having seen one in the inclosure after the lambs were admitted. With these lambs were two old bucks and a few sheep, which were either lame or otherwise ailing. They arrived in Washington, D. C., December 4, 1886, and were afterwards placed in stalls where they could not be re-infected excepting from each other. As Table B shows that there were no adult tæniæ in the lambs, re-infection could only be through the four older sheep confined with them. Re-infection could not possibly have proceeded from some Eastern sheep confined with them, for these sheep when examined had no *T. fimbriata*. No dogs were admitted to the box stalls where they were kept. Their food was Eastern clover and mixed corn and bran. They were furnished with well-water and salt. The adults were numbered 101 to 104; the lambs from 105 to 110.

December 9.—Two Eastern lambs, Nos. 111 and 112, were put in the pen with Nos. 101 to 110 inclusive. Nos. 111 to 118 were a number of Eastern coarse-wooled sheep, bought for experimental purposes.

December 13.—Nos. 111 and 113 were found to pass mature embryo bearing proglottides of *Tænia expansa*.

December 17.—Fed Nos. 105, 107, and 109 with proglottides of *T. expansa* from Nos. 111 and 113.

December 31.—Lambs Nos. 106, 108, and 110 were put in a pen with Nos. 111, 112, 113, and 115. And sheep Nos. 101 and 104 were put with Nos. 114, 116, 117, and 118. Later on some other changes were made, but as the Eastern sheep were found to contain no *tæniæ* when examined, these changes had no result, and could not have affected the result in other ways.

The object of arranging and re-arranging these sheep was to give possible chances of infection to the uninfected sheep.

Table B is compiled from data obtained from lambs born in 1886; from four wethers, which, with six of the lambs, were removed to the Experimental Station in Washington, D. C., and from a few lambs born in 1887. The sheep marked x, killed June 25, was also adult.

Table B shows that the *Tænia fimbriata* begins to appear in two or two and a half months old lambs, that they continue throughout the winter and gradually attain maturity as spring approaches. Each of the tables—A and B—shows that adult tape-worms were to be found throughout the year.

B.

Post mortem examination.	No. of lamb.	Number of tæniæ found.	Length of <i>T. fimbriata</i> .	Age in weeks.*	Time in weeks.	
					From Range—	In Wash- ington—
1886.						
Oct. 21	A	Few.	8 ^{cm} and under	23	.....	.....
29	B	Many.	10 ^{cm} and under	24	.....	.....
29	C	Do.	.....do	24	.....	.....
Nov. 9	D	Do.	.....do	25	.....	.....
10	E	3	.....do	25	.....	.....
16	F	Many.	10 ^{cm} and under	26	.....	.....
19	G	Do.	.....do	27	.....	.....
21	H	Do.	.....do	27	.....	.....
25	I	Do.	.....do	28	.....	.....
Dec. 26	105	4	2 ^{cm}	32	10	4
29	107	19	1 to 4 ^{cm}	33	11	4
30	109	100+	5 ^{mm} to 10 ^{cm}	33	11	4
1887.						
Jan. 8	108	Many.	1 to 7 ^{cm}	34	12	6
Mar. 14	103	50+	Immature and adults	43	22	15
29	101	Many.	.....do	45	24	17
Apr. 21	106	25	7 to 15 ^{cm}	49	27	20
28	102	15	Immature	50	28	21
28	104	5	.....do	50	28	21
May 7	110	1	Adult	51	20	23
Aug. 5	K	2	2 ^{cm}	10-12	.....	.....
5	L	2	2 ^{cm}	10-12	.....	.....
June 25	M	Many.	2 to 5 ^{cm} —adult .....	.....	.....	.....

* The age is that of the lambs and is estimated from May 15.

Nos. 101 to 104 and M were adult sheep; all others were lambs. Adult *tæniæ* contained embryo.

POST MORTEM EXAMINATIONS.

December 26.—No. 105 died. It contained four small *Tænia fimbriata*, the largest about 26^{cm} long, and fifteen cysticercci of *T. marginata*, each less than 1^{cm} in longest diameter.

December 29.—Killed No. 107. It contained nineteen small *T. fimbriata*, the largest about 4^{cm} in length, and twenty cysticercci, the largest a little over 1^{cm} in diameter.

December 30.—Killed No. 109. It contained over one hundred small *tæniæ*, ranging from 5^{mm} to 10^{cm} in length; also a few small cysticercci; apparently of same age as in 107.

January 8.—No. 108 died. It contained three specimens of *Tænia expansa*; one

of these was adult; many small *T. fimbriata*, varying from 1^{cm} to 7^{cm} long; also six cysticerci, somewhat larger than the earlier found.

April 20.—Killed No. 106. It contained many *T. fimbriata*, over twenty-five in all, which were over 7^{cm} in length; none were smaller. The duodenum and gall ducts were packed. None were adult.

May 7.—Killed No. 110. It contained one adult western *tænia* and several cysticerci.

March 14, 1887.—Killed No. 103. It contained from fifty to sixty *tæniæ* from 1^{cm} to 10^{cm} in length; four of these were in the gall ducts and were among the largest in size. *Tæniæ* immature to adult.

March 29.—Killed No. 101. Found *tæniæ* in duodenum, gall ducts, and pancreatic ducts. The gall ducts were engorged; the liver smaller than normal. The *tæniæ* ranged in size from 7^{cm} to the adults' length; three were adult. There were three cysticerci.

April 28.—Killed 104. Found five *tæniæ* from 2^{cm} to 4^{cm} in length, but no cysticerci.

April 28.—Killed 102. Found fifteen *tæniæ*. The largest were not over 7^{cm} in length, and immature. There were two cysticerci.

Table C is made up from data obtained from the six lambs, Nos. 105 to 110, inclusive, transported from the prairies to Washington. It shows the comparatively slow growth of the parasite; also the abundant infection of some of the animals so long as they were exposed to infection. It also presents either the possibility of infection after they were taken from the prairie or the retention of the embryo in the rumen through a considerable time.

C.

Date.	No.	Age in weeks.	<i>Tænia fimbriata</i> .	<i>Tæniæ</i> size.	Weeks after October 15.	Weeks after December 1.	Weeks after December 31.
Dec. 26	105	32	4	2 ^{cm}	10 weeks.....	4 weeks.....	
29	107	33	19	1-4 ^{cm}	11 weeks.....	4 weeks.....	
30	109	33	100x	5mm-10 ^{cm}	11 weeks.....	4 weeks.....	
Jan. 8	108	34	Many.	1-7 ^{cm}	12 weeks.....	6 weeks.....	1 week.
Apr. 20	106	49	25	7-15 ^{cm}	27 weeks.....	20 weeks.....	16 weeks.
May 7	110	51	1	Adlut.	29 weeks.....	23 weeks.....	18 weeks.

October 15, the date on which the lambs were taken from the prairie and corraled.

December 1, the date on which the lambs were received in Washington.

December 31, the date on which the adults, Nos. 101 to 104, were removed.

Lambs K and I, Table B, show that the *tænia* was developed to a length of 2^{cm} in less than ten or twelve weeks, for the number of *tæniæ* found shows a slight infection, and some time may have elapsed after the birth of the lamb before its infection.

Lambs A to I, Table B, show that in from twenty-three to twenty-eight weeks the *tænia* may develop to 8^{cm} or 10^{cm} in length, and that the infection is proportional to the time exposed. The infection is, however, a variable quantity, and no definite statements can be deduced.

As the lambs do not begin to nibble grass and drink water until some few days after their birth, the development of *tænia* in K and L probably required not over two months. Lamb A, examined October 21, about twenty-three weeks after birth, gives, when compared with K and L, an approximate rate of growth of the *tænia* of 2^{cm} a month, more or less. The rate of growth must so vary at different times that no definite rate can be determined at present.

The *tæniæ* of No. 105, one of the same lot of lambs as the foregoing, were no larger after thirty-two weeks than those of K and L after ten weeks. This points to a recent infection of No. 105, *i. e.*, within ten weeks, or about the time the lambs were taken off the prairie

and received into the corral. The *tæniæ* of Nos. 107, 109, 108, and 106 coincide with this; but the lambs No. 109 and 108 also point to a later infection, as many very small *tæniæ* were found in them. No. 108, which had *tæniæ* 1^{cm} long six weeks after its receipt in Washington, would lead us to suspect a recent infection; but this is not necessarily the case, as the influence of the rumen of the sheep in detaining the parasite for a length of time has yet to be learned. The absence of young *tæniæ* measuring less than 7^{cm} in No. 106 at sixteen weeks after its last association with an animal containing adult *tæniæ*, and twenty weeks after its arrival in Washington, is also of interest, in that it points to infection of the lamb from the adult sheep associated with it. No. 110 shows a very slight infection, and one, judging from the age of the *tæniæ*, that could have occurred in Colorado.

The six cases show a slow growth of the parasite; they also point to one of two things: that the *tæniæ* are, as embryos, retained in the rumen for some time after being swallowed, or that these *tæniæ* are continually infecting their hosts by the direct method. That is, the embryos passed by sheep pass with little or no preparation into other sheep and develop without the intervention of an intermediary host. So far I have found nothing to absolutely prove or disprove the latter statement. The infection, as shown by the various sizes found in these lambs and other sheep, points to a continuous infection nearly all the year. (See Tables A, B, and C.)

Nos. 106 and 110 indicate a cessation of the infection for the length of time it required the smallest (7^{cm}) to attain their size. Lamb A indicates the time to be something less than twenty weeks, or at the period when they were received at Washington. Nos. 106, 107, 108, and 109, which had been confined eleven and twelve weeks, show a great infection, as great as I have seen. This would happen with animals which were being infected in confinement, for the opportunities of infection, if the infection should prove to be direct, are greater. Various conditions, as the weather, food, water, etc., have so much to do with the problem of infection, that far more data are necessary.

The fact of slow development and continuous infection are the main points brought out in this experiment. Continuous infection is naturally one of the results where *tæniæ* are constantly developing and shedding ripe proglottides laden with embryos for the infection of other hosts. Continuous infection also leads me to suspect that no intermediary host is necessary for the continuance of the life of the embryo. This proceeds from the fact that no single species of mollusk, insect, or other animal is to be found at all seasons and places necessary to suit all the conditions under which we find the host infected.

Experiment No. 2.—A lamb dropped at a slaughter-house in this city was kept with its mother in an uninfected stall.

The lamb was fed on January 10, 1887, with a large quantity of proglottides of *Tænia expansa*, from No. 108. The embryos were found to be alive and moving before feeding.

On March 20 I fed the same lamb with proglottides of *T. fimbriata* from No. 103. These contained live embryos on the 18th instant.

On March 29 I fed the same lamb with proglottides containing embryos of *T. fimbriata* from No. 101.

Killed it April 19, 1887, and found nothing except a few white spots in and on the liver. The experiment had no results.

AN EXPERIMENT TO INFECT LAMBS WITH *TÆNIA FIMBRIATA*.

No. 3.—May 23, 1887, placed fifteen ewes with unborn lambs in three box stalls. They were fed on alfalfa, hay, corn, and bran. Their water was drawn from a hydrant near by. The ewes being poor, and taken from the prairie grass and placed upon dry feed, thrived but poorly. Between May 23 and May 29 eleven lambs were born, which lived until the close of the experiment. Five of the largest and oldest were placed with their mothers in stall No. 1. The remaining were divided between two stalls, Nos. 2 and 3.

These animals were removed from all sources of infection through food and water, and the lambs had never been exposed. The ewes were suspected of being infected with *T. fimbriata*. If the lambs became infected they would either take them of their mothers or from their feed. Between May 26 and June 15 I fed the lambs in stall A several times each with a number of ripe proglottides from adult *tæniæ*. An interval was left between each feeding, and each lamb was fed at least three times. The other lambs were not fed. All but two of the ewes were found to contain adult *tæniæ* when examined later.

The lambs and ewes were killed in nearly equal lots on June 25, July 15, and August 1.

June 25, killed one ewe and one lamb from pen No. 1, two ewes and one lamb from No. 2, and three dry ewes from No. 3. Lambs uninfected. One ewe had *tænia* 2^{cm} long.

July 15, killed two ewes and two lambs from No. 1, two ewes and two lambs from No. 2. Lambs uninfected.

August 1, killed two ewes and two lambs from No. 1, and two ewes and 2 lambs from No. 2. Lambs uninfected.

The lambs were kept immune for two months. The fed lambs were not infected in this time. This experiment shows that either a longer time is necessary for infection or that the embryo has to undergo some development or preparation that I did not allow, and of which I am ignorant. The specimens fed were taken from slaughtered sheep, examined with a microscope, and fed by placing the proglottides which contained moving embryos in the lambs' mouths and waiting until they had been swallowed.

The lambs while living with their infected mothers should have been infected, providing infection by embryos fresh from the host be possible. As this was not the case further preparation and development of the embryos outside of the ovine host seems necessary.



DESCRIPTION OF PLATES.

TÆNIA FIMBRIATA, Diesing.

[Plate I is a copy of Diesing's original figures.]

- PLATE I. Fig. 1.—Adult, natural size.
 Fig. 2.—Head, side view.
 Fig. 3.—Head, top view.
 Fig. 4.—Segments near head.
 Fig. 5.—Segments further removed from head than Fig. 4.
 Fig. 6.—Some still more remote.
 Fig. 7.—From near end.
- PLATE II. Fig. 1.—Adult, natural size. From contracted alcoholic specimen.
 Fig. 2.—Head, edge view, x 6.
 Fig. 3.—Head, side view, x 6.
 Fig. 4.—Head, top view, x 6.
 Fig. 5.—Portion of segment: *a*, genital pore; *b*, cirrus pouch; *c*, seminal apparatus; *d*, the efferent tube; *e*, the rudimentary uterine apparatus; *f*, vagina; *g*, the receptacle of the semen; *h*, fimbriae.
 Fig. 6.—Portion of segment more mature than Fig. 5: *a*, genital pore; *b*, cirrus pouch; *d*, efferent tube; *c*, the uteri.
 Fig. 7.—The uteri enlarged.
 Fig. 7*a*.—The uteri still further enlarged, showing the contained embryo.
 Fig. 8.—A half-grown tænia, showing the fimbriae, x 2.
 Fig. 9.—Fragment of tænia from near head, showing the lateral excretory vessels.
 Fig. 10.—Terminal portion of adult, x 2: *a*, segments which have lost their contractility; *b*, separated segments.
 Fig. 11.—External reproductive apparatus, x 40: *a*, genital pore; *b*, cirrus pouch; *c*, penis; *d*, vagina, crossed by the excretory duct.
 Fig. 12.—Adult segment showing the symmetrical arrangement of the reproductive apparatus: *aa*, genital pores; *bb*, uteri; *cc*, fimbriae.
 Fig. 13.—Embryos as they exist in the uteri: *aa*, envelopes; *bb*, embryo.
 Fig. 14.—Embryo showing envelope and its six hooks.
 Fig. 15.—Youngest tænia found. Natural length indicated by lines at their sides.
 All specimens except figures from 1 to 4 and 15 were drawn from fresh preparations.

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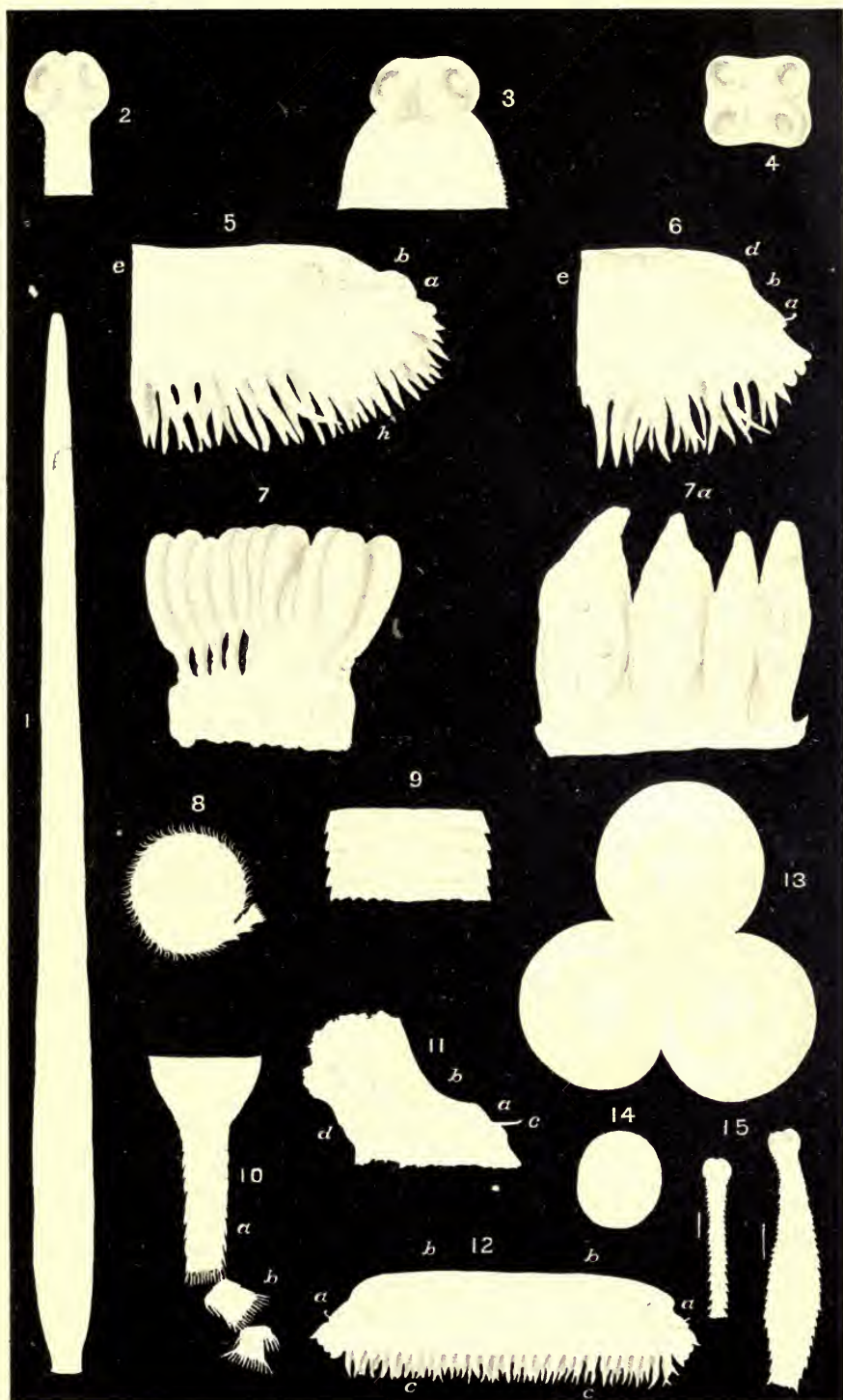
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TAENIA FIMBRIATA (DIESING)

THE INTRODUCTION AND SPREAD OF HOG CHOLERA IN THE UNITED STATES.

The accompanying correspondence, relating to the history and spread of hog cholera, covers a wide area of all the States and Territories of the United States. The letters are from statistical and other correspondents of the Department, and give, perhaps, as reliable and authentic a history of the appearance and spread of the disease in this country as it will ever be possible to collect. More than a thousand replies were received to the circular letter sent out by the Bureau of Animal Industry, and many of them were so carefully prepared as to be of much interest and value to those engaged in the breeding and rearing of swine. Nearly all agree in stating that at one time the swine industry was not subject to the periodical losses from epizootics which now cause such discouraging losses. From the first appearance of this class of diseases the outbreaks became more numerous and more wide-spread, until nearly all parts of the country are now subject to frequent invasions.

The first outbreak of the disease supposed to be hog cholera that is referred to occurred in Ohio in 1833. It is reported from one county in South Carolina in 1837, and from one in Georgia as having existed in 1838. It existed in 1840 in one county in Alabama, one of Florida, one of Illinois, and one of Indiana. In 1843 it is reported from one county in North Carolina. In 1844 one county in New York reports being affected. Its presence in 1845 is only mentioned by one correspondent from Kentucky.

The thirteen years, from 1833 to 1845, inclusive, form a period in which but ten outbreaks of swine disease, supposed by the writers to have been hog cholera, were mentioned in these replies. It is evident that during this period hogs were generally healthy throughout the country, and that the losses from disease were not sufficient to attract very much attention. The nature of the disease referred to as existing so long ago may, of course, be questioned at this day, and we have no means of deciding whether or not any particular outbreak was cholera or some non-contagious malady due to local conditions. It is reasonable to conclude, however, that the correspondents are correct in their opinion in most cases, because, since 1845, the outbreaks mentioned became more numerous year by year until we find nearly the whole country involved. This rapid increase of the number of affected sections would seem to indicate that a contagious disease had been introduced and carried to widely separated sections of the country, from which it extended until, with a year favorable to its propagation, we find a sudden and alarming increase.

Turning again to the number of outbreaks reported, we find, in 1846, that there were two in North Carolina, one in Georgia, one in

Number and dates of original infections of hog cholera, etc.—Continued.

States.	13 years, 1883-'95.	10 years, 1846-'55.	5 years, 1856-'60.	5 years, 1861-'66.	5 years, 1866-'70.	5 years, 1871-'75.	5 years, 1876-'80.	5 years, 1881-'85.	2 years, 1886-'87.
Maryland.....			1	2				3	1
Massachusetts.....				1				2	2
Michigan.....							2	3	3
Minnesota.....						1	1		
Mississippi.....			4	2	3		1	2	2
Missouri.....		2	6	8	16	8	8	2	1
Nebraska.....			1		1	2	3	15	3
New Hampshire.....								1	
New Jersey.....			2	1					1
New York.....	1				1			2	
North Carolina.....	1	7	4	10	9	3	4	2	
Nevada.....								1	
Ohio.....	1	11	7	6	9	12	7	1	9
Pennsylvania.....		1	3	2		2	4	3	1
South Carolina.....	1	1	3	1		1			
Tennessee.....		12	18	10	5				1
Texas.....						2	7		2
Virginia.....		4	2	5	3	8	4	5	3
West Virginia.....			2	2	4		4	1	1
Wisconsin.....			1		1		4	13	2

Whether the outbreak which occurred in Ohio in 1833 was the first introduction of hog cholera in this country or not can not now be determined. It seems reasonably certain, however, that the contagion was imported from Europe with some of the animals that were brought from there to improve our breeds of swine. The investigations made in England and on the continent during the last year demonstrate that the swine fever of Great Britain is identical with our hog cholera, and that this disease is also widely scattered over the continent of Europe. This being the case, it would appear much more likely that the contagion was imported from there, as we know occurred with the contagion of pleuro-pneumonia of cattle, than that it appeared spontaneously or was developed by the conditions of life in this country. Having been once introduced it spread gradually, following the lines of commerce and being for a long time confined to them, until, extending step by step, it has at one time or another invaded every section of the country in which swine raising is a prominent industry.

Dr. George Sutton, of Aurora, Ind., in 1858, wrote as follows :

I have seen notices of this disease prevailing in the States of Illinois, Kentucky, Indiana, Ohio, New York, Massachusetts, Pennsylvania, and Maryland. It has prevailed extremely in Indiana, particularly in Dearborn, Ohio, Ripley, Rush, Decatur, Brown, Bartholomew, Shelby, Johnson, Morgan, Marion, Boone, Posey, and Sullivan Counties. It has also prevailed in Campbell, Kenton, Boone, Gallatin, Carroll, Breckinridge, Bullitt, Bath, Henry, Henderson, Nicholas, Livingston, Union, and Crittenden Counties, Kentucky. It has also prevailed in Hamilton, Butler, Clinton, Fayette, and Clermont Counties, Ohio. Also in different portions of Illinois, and very severely in Wayne, White, and Gallatin Counties. It has also prevailed in the State of New York. The Ohio Farmer for January 3, 1857, quoting from the Buffalo Republic in regard to the extensive prevalence of the disease, says that "In western New York, especially, we learn it has been very fatal, but is now over. In conversation with one of the most extensive dealers in the neighborhood, a day or two since, he informs us that about six weeks ago he lost about four hundred hogs in a very short space of time. A distiller in Jordan, during the month of September, lost fourteen hundred, which cost, in addition, over \$1,000 to have them buried. In Rochester, at all the principal points, and even among the farmers, the mortality has exceeded anything ever before heard of. A butcher in this city not long since purchased \$500 worth of fat hogs, but they died so rapidly on his hands that he scarcely realized \$75 on the investment." The Worcester (Mass.) Spy reports that many farmers in that city and vicinity are losing their swine by the mysterious

and fatal disease known as the hog cholera. In the southeast part of the town it prevails in a greater or less extent upon nearly every farm.

In most cases the disease is traced to Western hogs that have been sold by the drivers the present season, and which seem to have communicated the contagion to the other inmates of the sties in which they have been kept. It is known that of many droves of Western shoats that have been sold at Brighton this season, and peddled about the State, nearly all have died. The disease has, no doubt, prevailed extensively in other parts of the country, of which I have seen no notice. In this section of the country it has been extremely fatal. Over portions of Dearborn County it spread from farm to farm, and some of our farmers lost from 70 to 80 out of 100 of their hogs. At the distilleries the mortality has been very severe. I received information that more than 11,000 died at the distillery in New Richmond in the summer and fall of 1856. The owners of the distillery at Aurora inform me that they have lost between 6,000 and 7,000. A gentleman informs me that he lost in 1856, at Ingraham's distillery in Cincinnati, from the 1st of August up to the 24th of October, 1,285, losing 1,152 out of a lot of 2,408. Another gentleman informs me that at the distillery in Petersburg, Ky., he lost from the 1st of June up to the 18th of October, 1856, 2,576. I have also received information from several other distilleries where the losses were large.*

According to Dr. Sutton, this disease first appeared in Dearborn County, Ind., in July, 1850.

Dr. E. M. Snow writes that—

During the last five years this disease has been seen, from time to time, in portions of the more eastern States, some times, as in western New York in 1856, proving quite severe and fatal, in comparatively limited localities. But in the Eastern States it has, to a great extent, originated with and has generally been confined to hogs imported from the West. I think that in no State east of Ohio has the disease prevailed extensively or attained the character of a wide-spread epidemic.

In the vicinity of Providence, R. I., it has prevailed to some extent, more particularly among large herds of swine during each of the last five winters, but has been mostly confined to hogs brought from the West, and has usually disappeared with the approach of warm weather. During the last winter it was more severe than in any preceding, and was not confined to Western hogs. Neither did the disease, as heretofore, cease with cold weather, but it continued until August, having destroyed more than 500 hogs in Providence and in the adjoining towns during the first seven months of the present year, 1861. I have also heard of its prevalence in various towns in Massachusetts during the same period.†

The losses from hog cholera in the United States have been enormous. Estimates have from time to time been made from carefully compiled data, and these have, so far as the writer is aware, never been less than \$10,000,000, and have reached \$25,000,000 annually. The inclusion of losses from other diseases is, however, unavoidable in such estimates, and consequently some allowance must be made for these. The recent identification of an epizootic pneumonia of hogs by the Bureau of Animal Industry, a disease which appears to be identical with the *Schweineseuche* of German writers, shows that the varieties of swine diseases in this country are more numerous than has been supposed. The erysipelas of Europe (French *rouget*; German, *Rothlauf*) and charbon have not yet been identified as occurring in an epizootic or enzootic form among swine in the United States, but the existence of these diseases is not impossible, as the investigations have not yet been sufficiently numerous to reveal the nature of all such outbreaks. The diagnosis of such diseases has been very uncertain in the past, because the symptoms were not

* George Sutton, M. D. Observations on the supposed relations between epizootics and epidemics, and experimental researches to ascertain the nature of the recent epizootic among the swine, and the effects which diseased meat may have on human health. The North American Medico-Chirurgical Review, May, 1858, pp. 483-504.

† Edwin M. Snow, M. D. Hog Cholera. Annual Report U. S. Department of Agriculture, 1861, p. 147.

clearly defined, and not always sufficiently characteristic. The most reliable means of discrimination between these maladies at present is the isolation of the microbes which produce them. The characteristics of these organisms are now so well known that the bacteriologist has no difficulty in distinguishing between them.

As to the nature and treatment of hog cholera, as determined by the inquiries and investigations of the Bureau of Animal Industry, the reader is referred to the recent report published by the Department. The attention of the reader is now directed to the following replies to our circular letter, which was sent out in the fall of 1887:

ALABAMA.

AUTAUGA.—Since 1866 hog cholera has appeared at intervals in this county. Some years it has destroyed two-thirds of the herds, but at no season has it visited the entire county. Some farms are skipped by the disease. The past season the loss by this disease has been very serious, and, occurring at the busiest portion of the year, the neglect caused the loss to be greater. It is thought that the disease can be prevented if not cured by the use of hog food, viz., corn soaked twenty-four hours in hickory ashes water, with a small addition of copperas. The above should be furnished to hogs before getting sick, when they will eat. "An ounce of prevention is worth a pound of cure." After taking the disease calomel should be used. Many writers attribute the disease "to impure water and filthy pens." This is an error, so far as this section is concerned, for our hogs take the disease and die whilst running in the woods or in wild range. Wild hogs die with it also. Very rarely are they cured when they take the disease. Kerosene oil is a good preventive.

BULLOCK.—There has been no hog cholera in this county the past year. The writer has no special theory in regard either to the history or pathology of the disease, or its proper treatment.

CALHOUN.—Hog cholera appeared in this county about 1863. As to the means or mode of its treatment, no one knows anything reliable. Prior to that time such disease was unknown here. Last year but few hogs died of this disease in this county. As yet no preventive or specific remedy has been discovered. One man told me he always kept a good large pile of wood ashes, and a little salt mixed through the ashes, in his hog lot where all his hogs could eat it at pleasure, and that he never had lost one by cholera even when his near neighbors lost all of theirs.

CHILTON.—Hog cholera has existed in this county since 1840 to my knowledge. Hogs that are well fed and given proper attention scarcely ever have it; but those that run at large and get poor during winter and spring, and then are put on oat pastures, generally contract the disease. It is only wide-spread and fatal when no attention is given the animals. More attention is now given live stock than formerly.

CHOCTAW.—From the best information I can obtain the disease of hog cholera first made its appearance in 1861 or 1862. No idea as to the mode of its introduction. As a general thing hogs were healthy up to 1861, and we had but little trouble to raise them. Now you find hogs looking well and fat, and possibly in two or three days they commence to die. Those that are poor linger with the disease, but those that are fat die in a short time after being attacked. I have known the cholera cured with soft lye soap, and think if given in time it will prove a preventive. Some animals are dying now in this vicinity. But every hog that dies in this county has not the cholera. A good many die from snuffing dust and eating cotton seed, but when one dies the first thing you hear is cholera. Both cattle, horses, and sheep are in good condition.

CLARKE.—We have had but few cases of hog cholera, and those were in isolated sections of the county.

CLAY.—Almost any fatal sickness among our hogs is denominated hog cholera. I have failed to find any reliable information as to when it first began to prevail here. Up to that period hogs were generally healthy.

COLBERT.—The condition of all kinds of live stock in our county was generally good during last year. We have been almost exempt from hog cholera during the year, but for eight or ten years past the disease has annually decimated the hog crop. No one here has found any remedy or prevention for it. In fact, with the greatest care that has been taken of our hogs, the disease sometimes prevails in the most malignant form and under the best care and treatment. It seems to be a disease that none of our people can account for. It is of recent origin with us. I

had never heard of a case in this vicinity up to fifteen or twenty years ago. Some persons say it was never known here until new breeds of hogs were introduced.

CULLMAN.—There has been less hog cholera in this county this season than for several years past. There are various opinions as to the cause. Its first appearance in this county, as near as I can ascertain, was in 1863. The remedies are various as can be imagined. There is no prevailing disease or epidemic among any class of domestic animals. As a general thing farm stock is being better cared for than formerly.

DALE.—No case of hog cholera was ever known in this county previous to 1865. How it got here or where it came from, no one knows. Since that year it has been continuously in the county, some years doing more damage than others. We had no disease among hogs previous to that time and have none now but that. Hundreds of remedies have been tried to no avail. For two months past the loss has been heavy. Enough of pork is lost annually to feed the people in the county. No preventive has been discovered as yet.

DALLAS.—As to hog cholera, I do not know exactly when the disease first came around. I remember of hearing of it in the spring of 1857 or 1858, and in the early fall of the same year thousands of hogs died with the disease called by the people hog cholera. I think, however, that "pneumonia" came around about the same time. Both were called hog cholera. The disease has been in the county more or less ever since, and sometimes to an alarming extent. It has not been so bad, however, since the number of hogs have been reduced. Hogs were considered to be healthy previous to the appearance of those diseases. Only kidney worms troubled them before the cholera. All stock is better cared for now than a few years ago. Better pastures are provided and less corn fed, and a better class of stock is now raised.

DE KALB.—I have been a citizen of the county and a farmer thirty-five years. My first recollection of hog cholera was twenty-eight or thirty years ago. One of my correspondents says: "About twenty-five years ago a drove of hogs passed through the county, and shortly after hog cholera appeared." Previous to 1858-'59 hogs were generally healthy. They were occasionally affected with "quinsy," rather as an epidemic. There were occasional cases of blind staggers and a few other diseases. There must be several diseases of hogs that are called "cholera," or the disease must assume several different shapes. Within my observation there has been diseases among hogs that were very destructive to life and called "hog cholera," that at different times affected the animals very differently. I inclose herewith two prescriptions for keeping hogs healthy, which, I think, is worth as much as a preventive as a remedy that will cure after the hogs become sick:

"Take 2 parts sulphur, 1 part copperas, 1 part alum, 1 part saltpeter, and 1 part black antimony. Mix well and give 1 ounce of mixture to 3 to 5 hogs, according to size, once a week every alternate month. Mix in slop or meal or in any way to get the hogs to eat it well, and get it equally distributed, or nearly so, among them." Again: "Give to each hog, once a week, one ear of corn that has been soaked twenty-four hours (or longer) in strong lime water. It is easiest to manage to soak the corn in the ear."

Horses, cattle, and sheep have been generally healthy for the last year. Hogs during part of the year, in some localities, were affected with what was termed "hog cholera."

ELMORE.—Our hogs have been affected and many have died of cholera. It first appeared in this county more than twenty years ago. Hogs were universally healthy before this disease made its appearance among them. I do not know how it was introduced originally.

FRANKLIN.—Generally speaking, hogs have been healthy. Some localities, however, report hogs dying with something like cholera. I have observed that some, after having recovered from the disease, shed off the hair. In other localities the symptoms are weakness in the loins, and after a day or two, while in apparent good order, die. Most of these diseases prevail among hogs found around gin houses.

GREENE.—Hog cholera first made its appearance in this county, so far as I am informed, about the year 1862, the animals being, previous to the invasion, in ordinary good health. The planters in some sections of the county suffered serious loss, it being just at the beginning of the war. When it would make its appearance in a drove, of say 100 hogs, it would destroy perhaps nine-tenths of them in a few days.

HENRY.—It has been about seventeen years since hog cholera was first discovered in this county. Previous to that time hogs were healthy. A great many hogs have died this year from the disease. There is a great improvement in the management and care of stock. Stockmen are trying to improve and raise finer breeds and animals than formerly.

JACKSON.—Hog cholera made its appearance in this county something like twenty years ago, and it has prevailed in different parts of the county every year since. Some years it is worse than others. It attacks hogs in different localities with more or less severity, breaking out in places say 4 or 5 miles apart, leaving but very few hogs, often not one.

LAWRENCE.—To ascertain the cause of hog cholera has baffled all efforts, as well as to find any means to cure the disease. Where the hogs have had fresh spring water in the mountain the disease has been as fatal as in the valley, where, in many places, they could only get stagnant water from stock ponds. It was found that by keeping them free from lice they improved and withstood the disease much better than when neglected in this respect.

LIMESTONE.—Some sporadic cases of hog cholera are reported as having occurred in this county in 1858. But few persons, however, sustained heavy losses before 1865. Hog cholera is supposed to have appeared in Lawrence and Morgan Counties, Ala., and Giles and Lincoln Counties, Tenn., before it did here. Deductions from experience would seem to be that the improved breeds of hogs, Berkshire and Poland-China, are more subject to cholera than our native breeds. It is supposed that our native breeds were healthier, because they had a greater variety of food and greater extent of territory upon which to run and sleep.

MARION.—The first hog cholera in this county was in the year 1866. No cause is known, or how it came into the county. Up to that time hogs ran in the forests, but as the county grew older and was cleared up hogs were confined to pastures. Disease then became more prevalent. There was no disease among hogs in this county prior to the above year.

PICKENS.—It is believed that hog cholera was brought into this county from Tennessee, but in what year I can not say.

WALKER.—Hog cholera was here before I came to this county. Hogs were generally healthy before cholera made its appearance. I was born and raised in the county, and my recollection is that it made its appearance about the year 1856. Sorghum-cane seed was sent into our county about that time, and I have always believed, and I believe yet, that that is and was the cause of hog cholera. I think so because they both came together, and my opinion is that if the matter was investigated it would be found that they have spread over this entire county together.

WASHINGTON.—Hogs were generally healthy up to 1862. Since that time we have had more or less hog cholera, in some parts of the county, every year. Some localities will miss for one or two years. Some years it is very fatal; in other years again not so fatal. For the past twelve months it has not been so bad, but owing to cholera previous to that time there will not be as much meat killed. Young hogs are generally healthy at this time.

WINSTON.—In the fall of 1862 a drove of hogs from Tennessee passed through this county and introduced what was pronounced hog cholera. Previous to that time hogs were generally healthy, and such a thing as hog cholera was unknown. From 1862 to the present time hogs have been more or less affected with this disease. In 1882 1,000 head died with what was called cholera. It is a strange disease. Hogs apparently well at night are found dead in the morning, and what is still more strange, in a pen of 10 fat hogs 9 will die. There is no cure known here. All admit it is a blood disease. Blue vitriol, turpentine, and slops are good preventives. I had two fine hogs to die two years ago. They were both fat, and I saw nothing wrong with them at night; but they were dead in the morning. I had one opened, and the lungs, heart, and intestines were dark looking, with bloody streaks through them.

ARKANSAS.

ARKANSAS.—I have never seen a genuine case of hog cholera since residing here (seven years). Last year mast was a failure, and many hogs died during winter from poverty and cold, but where fed they did very well.

ASHLEY.—I do not think that the genuine hog cholera has ever been in this county. In 1882 many hogs died, but they run at large in the woods and no care was taken of them, except to rally once or twice a month to keep them gentle enough to manage. Last year a disease called hog mummies prevailed here, and about 10 per cent. died. The symptoms were as follows, viz: First, the hog was sluggish for two or three days, then fever intervened for three or four days, which ended either in death or improvement in six or seven days. The hogs broke out in small eruptions and the skin in small blisters; next the cuticle became dry and all peeled off. A new skin formed, the animal nearly dying. In thirty or forty days it would begin to improve in flesh and soon be fat.

BAXTER.—The first appearance of hog cholera in this county was in the year 1862.

It was very fatal then. I have no idea as to the time of its introduction into the county. There has been very little of the disease since that time, it having been confined to a few localities in the county, and lasted but a short time.

CLAY.—There is little hog cholera in this county this year. Some years hogs die very rapidly from cholera, and then for two, three, four, or five years the disease will not be destructive. It first made its appearance in this county about 1854-'55. The cause is unknown. I can not give you anything correct in regard to death rate. The disease has not prevailed this year.

CLEVELAND.—Hog cholera made its first appearance in this county in 1863. At that time the county was full of hogs. It appeared in October and killed three-fourths of the hogs in the county. It took the disease longer to go through the country then than now. It makes its appearance every three or four and sometimes five years. Previous to 1863 hogs were healthy.

CONWAY.—The disease called hog cholera was first known among hogs in this county in the year 1876. Since that time it has occurred biennially. Two years ago more than two-thirds of the hogs died. About one month ago the disease made its appearance again, and since then a great many of the hogs of the county have died. It seems to me more fatal to hogs that have been fattened. The disease seems to have gradually moved up the Arkansas River since its first introduction into the county.

CRAWFORD.—There exists a great diversity of opinion in regard to the disease of hog cholera. Some are of the opinion that the disease has been brought here by importing fine stock for breeding purposes, but I am credibly informed that there was one visitation of the disease "before the war." One correspondent thinks the disease incurable, but that it may be prevented by the use of salt, copperas, turpentine, ashes, etc., and isolation. Another says he has not lost a hog for ten years. He gives plenty of salt, some slops, and corn regularly. At this time there is no cholera known to exist in the county. I think the idea that native hogs are exempt from the disease is all a heresy. Cotton seed for pigs and shoats, if persisted in, is nearly sure death. Bitter mast is not healthy for hogs. I believe isolation, with salt and ashes, will nearly if not altogether exempt hogs from disease. A good preparation to keep them in health is to take corn-cobs, put them in a pile, set fire to them, and when pretty well charred extinguish the fire with salt brine, then feed to the animals.

CROSS.—There is a difference in opinion in regard to hog cholera. Some think it is caused by impure water or impure food. But it is always worse after a visitation of the Buffalo gnats than at any other time. I think the main cause is eating cotton seed, and the poison from the Buffalo gnats. As to the year of its first appearance in this county I can not say, but it has been here for at least twenty-five years. The laws of this State now prohibit any feeding of cattle on cotton seed outside of an inclosure. This may help the cause some.

FRANKLIN.—It is thought by many of the most observant farmers that hog cholera was introduced into this and adjoining counties with the introduction of the improved breeds of hogs. I do not remember the year it made its appearance—some fifteen years since, however. For several years it seemed to be mostly confined to and was more fatal among the Berkshire and breeds crossed with the Berkshire than among other breeds of hogs. The common hogs of the country were exempt from cholera. The county being new and sparsely inhabited, hogs measurably subsisted on the range. They were healthy, industrious, and self-sustaining. But when the improved breeds were brought into the country, supported on grain, and confined to the inclosures, cholera began to make its ravages among them. So far no reliable cure has been found here. Those who feed well and give their hogs salt, ashes, charcoal, copperas, and other things, in the main have healthy and thrifty hogs, and lose but few from disease; while those who do not feed well and give but little attention to them lose largely.

DESHA.—Hogs have died here since 1863, in large numbers, with what the people call hog cholera. Its introduction seemed to be spontaneous, and no cause is known. Hogs in this county run at large in the range, and no man knows how many the "hog thieves" get, how many the wild cats eat—the wolves, the bear, panther, all have their share with hog cholera, and the owner perhaps gets one-fourth and oftener one-fifth or one-sixth of the whole. No remedy has been found for the disease, and very little effort is made by the people because they think the malady incurable.

FAULKNER.—The first time I ever knew of any hog cholera in this county was in 1862. Again in 1881 we had an outbreak of the disease, though some report cholera almost any time when their hogs die. Hogs before taking the cholera seem to be in good condition. I never knew a poor hog to die with the disease. I know of no cause. I think that the red mange is our worst disease. It is always more fatal after a heavy, bitter mast. When cholera gets in a bunch of fat hogs at night the next morning three or four of them may be found dead in their beds.

GARLAND.—There has been no disease among domestic animals the last year in this county. All stock is remarkably healthy. The first introduction in this county of hog cholera was, I think, in 1872, though it had been known in the State long before that time. Some farmers think it was introduced into this county by the introduction of fine blooded hogs brought from the old States shortly after the war. Hogs were free from disease in this county up to that time.

GREENE.—Hog cholera made its appearance here many years ago. It is generally conceded by stockmen that cholera follows a white-oak mast. Whether this is correct or not we can not say, but are inclined to pander to that opinion. Hogs are reasonably healthy here just now, but there has been some cholera reported in different localities during the summer and early fall. We have something like scab or mange among the hogs during summer. This is a hog country if they could only be kept healthy. I have seen pork killed out of the woods in July that had not been fed on anything. Along the railroads cattle were affected by a disease which was thought to be Texas fever. The disease was not very fatal.

IZARD.—Hogs have been dying here from what is called cholera for a long time past. The disease differs, but as we have no veterinary surgeon it is all called cholera. The last attack, about eleven months ago, was more like measles than cholera. The hogs "broke out" with little lumps all over them. We had a very dry season through spring, summer, and fall, and as soon as the rains began the disease ceased almost entirely, and I think it was for the want of water and too much dust that caused the epidemic. All other stock is generally healthy. I can not give the date of the introduction of the disease.

JACKSON.—Cholera has prevailed among hogs ever since 1874, but the most fatal years were 1880, '81, '82, and '83. The disease was called cholera, but it seemed to affect them in various ways. While some hogs would seem to have good appetites, they appeared to have no use of their jaws, and their teeth seemed to be sore. They could not eat, and would dwindle away and die in a few days. Others would take to vomiting and purging. Their thirst was very great, and death would soon follow. When first taken, if put in a lot where they could not get to water, and were given warm slops in small quantities, with one teaspoonful of saltpeter to one gallon of slop, with lye soap dissolved in slops, and condition powders used, a cure was generally effected. The health of the hogs, as well as all other farm animals, has been good the past year.

JOHNSON.—About six years ago a disease prevailed here among hogs that was generally called hog cholera, and again in the winter of 1885-'86. I can give no idea as to how the disease was introduced. Most of the hogs died in those years, and there is not yet an average lot of hogs in the county. Those left after the ravages of the disease seem to be healthy.

LAFAYETTE.—As to hog cholera, we have in this county once in from two to five years some disease that kills a great many hogs, and it is generally called cholera. There has been no such disease among hogs this year in this county—I mean what is called hog cholera. It has not existed for about twenty-five years, according to the best information that I can get. Some years when the cholera is here—or what is called cholera—it has been known to kill as high as 75 per cent. of the hogs in the county.

LAWRENCE.—Up to ten years ago there were but few hogs died of disease in this county, but about that time a disease, commonly called hog cholera, appeared in different localities, and a greater or less number have died every year since; but more have died within the past two years than ever before in the same length of time. Recently pigs and shoats (under one year old) have generally been affected more than the older ones, although many older ones have died of some complaint. The disease is not now very serious, although some are still dying. If there has ever been any preventive or remedy that was worthy the name of a "sure-cure," I have no information in regard to it. Various remedies have been tried, and some had a favorable effect in some cases, while in other instances they seemed to utterly fail.

LOGAN.—I can not tell when hog cholera made its first appearance here, but hogs have it every four or five years. There are more hogs killed here with cotton seed than by cholera. Hogs are generally healthy, cholera not being very destructive this year. A great many cattle have died of bloody murrain. Sheep are affected with a disease which causes them to run at the nose. It has proved quite fatal.

NEVADA.—The hogs in this county have nearly all died of cholera or a disease supposed to be cholera. The best remedy we have found is tobacco. We boil and make a tea of it and mix with ground feed. It has been a success in every case tried, both in hogs and poultry. There has been no other disease among stock in the county that I know of.

OUACHITA.—During the fall of 1886 and the winter of 1887 at least three-fourths

of the hogs of this county died with the disease known as hog cholera. After the opening of the spring of 1887 the disease seemed to subside, but now it has appeared again, and numbers of young hogs are dying. As to when the disease made its appearance in this county, I am unable to say. In 1863 there was a very fine mast of acorns, but rather late ripening, and on the 25th of October a frost came, which nipped so as to damage them; after this the hogs began to die, the same as now. It is called hog cholera, and has prevailed more or less in this county since that time. If there is any sure remedy for the disease it is not known here. Horses and cattle are comparatively free from disease.

POINSETT.—One of the greatest evils the farmers of this county are compelled to contend against is hog cholera, which, according to statistical reports, made its appearance here in 1858. It first made its appearance north of here, and gradually came south. It has made its appearance here many times since, in various types or forms. Nearly every year we have more or less mast, and after a good mast the cholera is worse. I attribute a good deal to the carelessness of the owners. When the mast gives out it is then the hogs need some preventive, but they do not receive it. When there is a year or two of poor mast the hogs increase in numbers, and after a good mast year they decrease.

POLK.—Hog cholera was first known in this county eighteen years ago. It has only visited this county as an epidemic twice since the organization of the county. A very small per cent. of horses die with blind staggers; also, a small per cent. of cattle die of murrain. This county can hardly report any loss upon stock of any kind, it being so extremely healthy. This we attribute to pure water.

POPE.—About 1860-'61 was the first I ever heard of any disease among hogs in this county. A greater or less number of hogs have died each year since then, but it has only been of late years that they have died by the wholesale. Some years they almost all die in certain neighborhoods, while in other localities they escape. The next year that neighborhood suffers and the others escape. Numerous remedies are used, but all fail to stop the disease after it once gets into a herd or locality.

ST. FRANCIS.—A disease known as hog cholera visits this county every year or two, and kills about 50 per cent. of the hogs of the county. It made its appearance in this county back in the fifties. Diseases of hogs generally follow a crop of heavy mast. It is not known how the disease was introduced into this county.

SCOTT.—Stock of all kinds have been very healthy during this year. Very few hogs have died, and none with the so-called cholera.

VAN BUREN.—Hog cholera first appeared in this county during the fall of 1876. It was very destructive, killing out many of the finest herds. It appeared in the eastern portion of the county, attacking several of the finest herds almost simultaneously. It is not known how the disease was first introduced into the county. It does not prevail every year. It invariably appears first in the east and southeast and gradually proceeds in a northern and northwesterly direction. It was very severe in 1876. Then again in 1878 it appeared, but in a milder form. From that time the county was apparently free from the disease until 1882, when it again appeared and was very destructive. Again in the fall and winter of 1885-'86 it was very destructive. The sows that had it and recovered brought no pigs for a year afterwards. There have been but few cases since that time. All advertised remedies have been tried, with but little effect. A mixture of charcoal, ashes, salt, and copperas, mixed with meal and fed dry, is most relied on as a preventive. Hogs were generally healthy previous to its introduction.

WASHINGTON.—It is the belief of old citizens in this county that hog cholera was brought here with improved stock from the North about 1867. Previous to that time no such disease was known among the native hogs. It is believed that fully 20 per cent. are lost annually on an average, and no remedy has yet been found for it. Our best farmers think the disease is now on the decrease. It is difficult to raise pigs for one year or more after a severe epidemic of cholera.

WHITE.—Hog cholera first made its appearance in this county in 1872, when nearly all the hogs in the county died. Since that time it has prevailed every few years, making the raising of hogs a precarious business. Various opinions are held in regard to the cause of the disease, but it is most generally believed that "mast" (acorns, hickory nuts, etc.) is a fruitful source of cholera, as the disease is more prevalent after a mast year. Hogs that are kept up in clean quarters seldom have the cholera. We have occasionally a case of murrain among cattle, and some years the disease prevails to a considerable extent. It is sometimes called "Southern fever," "Spanish fever," "Texas fever," etc., which I think are only different names for the same disease.

ARIZONA TERRITORY.

APACHE.—Hog cholera has never been known in this county. Blackleg prevails occasionally among cattle.

COCHISE.—I have not heard of any disease among hogs in this county. As for hog cholera, I do not think there ever was a case of it in the county.

MARICOPA.—Hog cholera is not known in this valley, nor, so far as I can learn, in any portion of Arizona. Hogs are absolutely free from any and all infectious or contagious diseases in the Salt River valley. They are raised upon alfalfa and fattened, or, rather, *hardened*, upon wheat, corn, or barley, which destroys the strong grass flavor. The only disease known among cattle is an occasional case of blackleg when fed on alfalfa plant—when the feed is luxuriant in the early spring months. Horses, hogs, and sheep are almost absolutely free of disease of any sort. This condition is attributable to purity and dryness of our atmosphere, together with the slight saline quality of the water in this section of Arizona.

CALIFORNIA.

ALPINE.—No hog cholera seems to be prevailing in this county.

AMADOR.—Hog cholera is not, nor ever has been, known to prevail in this county. About 20 head of cattle have died of a disease supposed to be blackleg.

BUTTE.—There has been no epidemic among hogs in this county. All cases of hog cholera that have come under my observation have entirely disappeared with proper care, plenty of feed, and warm, dry places to sleep. Parties that meet with best success in hog raising in this county always have plenty of pitch-tar, salt, and charcoal where the hogs have access to it, especially during the rainy season. They also use freely of red peppers in pods, in steeping them and pouring over food.

CALAVERAS.—Hog cholera is but little known in this county. A good many hogs have died, but I am unable from any information I can obtain to certify that that was the cause. A good many young cattle have died this season from a disease known as blackleg. Still I am not satisfied that this is the disease with which they were affected.

FRESNO.—There has been no hog cholera in this part of the county, and I am not sure of its ever having appeared in any part of the county. The hogs here have never had any epidemic of a serious character. Horses have had several epidemics of influenza, and the "pink-eye" has, in a few cases, proved fatal, but not enough to class it as epidemic. Cattle are uniformly healthy, and do well here on account of mild winters.

HUMBOLDT.—Hog cholera has been reported in one or two of the counties south of this, and has proved very fatal. I believe it was imported with hogs brought from some distance. I have not heard anything of it for some months past. This county has always been a healthy one for hogs. About 40 horses were lost by glanders last year, and 10 head this year. The action of the county authorities seems to be stamping it out.

LASSEN.—No hog cholera prevails in this county, and no other disease seems to affect this class of stock. There has been some pink-eye among horses, and a small percentage has been lost. Cattle have suffered a little by blackleg, and a small percentage have died. Sheep have suffered to some extent from scab.

MARIN.—The first appearance of hog cholera in this county was during last summer. Out of 200 head of store hogs bought in San Francisco and shipped to the dairy ranche of Mrs. A. J. Peirce, about one-half died. The cause is not known. This is a very healthy county for hogs. It is evident that the disease was contracted in San Francisco.

MODOC.—We have no hog cholera in this county. The only disease that has prevailed among any class of animals has been blackleg among cattle. A large number of animals have died from this malady. We have no remedy for it.

MONTEREY.—Do not think any animals have been affected with hog cholera in this county; at least I can not learn of any. Hogs are left to shift for themselves like other animals here, being fed mostly on dairy slops, alfalfa, burr clover, and such weeds as they can pick up. But very little grain is fed to hogs here.

PLACER.—There has been no hog disease in this county to my knowledge for the last twenty years. There is a considerable diminution in the number of hogs in the county on account of the low price of pork during the last two or three years—I would judge at least 25 to 30 per cent. There was a mild disease among horses this last fall—a kind of horse distemper—a running at the nose and swelling under the throat, but none died of it that I heard of. It was principally among young stock.

SAN BENITO.—While hog cholera exists to an alarming extent in some counties of the State, I have been unable to learn of a single case in this county. It is such a dreaded scourge that people have been extremely cautious about bringing hogs into the county from outside districts, even for propagating purposes, and the result is as stated above.

SANTA CRUZ.—There are no well-defined cases of hog cholera in our county. All stock in its usual good condition.

SAN MATEO.—Hog cholera is almost unknown in this county, and there is nothing much to be said about it.

SONOMA.—No cholera has ever made its appearance and our hogs are generally healthy. No farm animals have died of contagious diseases in this county the past year that I am aware of.

STANISLAUS.—Hog cholera prevailed last year. Fattening hogs, stock hogs—young and old—died to the extent of 20 per cent. This year the disease has not made its appearance. Nothing is done to prevent the spread of the disease, and no remedy has been tried. The disease first appeared four years ago on old hog ranches where the business had been followed for years, the hogs living on mast alone. Cattle and sheep are in very poor condition on account of the scarcity of food.

COLORADO.

BOULDER.—We know of no hog cholera in this county. Blackleg has prevailed to some extent among cattle, entailing a loss of perhaps 1 per cent.

CONEJOS.—Hog cholera is an unknown disease in this county. Some flocks of sheep are affected with scab. As a general thing all classes of farm animals are in an exceedingly healthy condition.

CUSTER.—There is no cholera or any other disease affecting hogs in this county, nor is there any disease among cattle or horses. W. W. Draper took 125 head of hogs from this county to Pueblo County to feed at a slaughter-house there, and lost them all, or nearly all, by cholera, but the disease is not known here; my impression is that the refuse of the slaughter-house was the cause of the disease.

DELTA.—There is no hog cholera here; hogs are all healthy.

EL PASO.—There has been no epidemic or serious disease among any class of farm animals in this county during the current year. The losses from all causes have been inconsiderable. But few hogs are raised in the county, and no cholera prevails among them that I have heard of.

FREMONT.—Hog cholera is not known in this county.

HUERFANO.—It affords me pleasure to report that hog cholera is unknown in this county. During a residence of seven years here I have not heard of a case of the disease, and never heard of a hog dying of any disease in the county. Native cattle are free from disease also. The only disease among sheep is scab, and this malady is confined exclusively to Mexican flocks.

MESA.—There has never been a case of hog cholera in this county.

OURAY.—Have never had hog cholera in this county. Have but a small number of hogs in the county. The farmers only raise a few for home consumption. This county has been settled ten years and I have never heard of a hog dying with any disease.

PITKIN.—Cholera attacked hogs in this county two years ago. They were fed on swill and stale food from hotels. Previous to that time a number of hogs died from apparently the same disease caused by the same kind of food. Hogs are generally healthy this season. Other animals are generally healthy and do well where they are properly looked after. This is quite a stock county. Horses, cattle, and sheep all do well.

SUMNER.—Reliable information leads me to believe that we have no so-called hog cholera in this county. Some "quacks" report it, but such report is contradicted by the animal itself. For instance, a sow on the Call farm was taken sick and would not eat. "She has the cholera." I gave her a teaspoonful of sulphur and one of salts. She recovered in two days.

CONNECTICUT.

LITCHFIELD.—Hog cholera first appeared in the State in 1881, in a few pens, and became quite prevalent in 1884. Since that time a knowledge of its contagious nature has nearly obliterated it from the State, yet there are still occasional outbreaks, probably introduced by other means than hogs. We have no infected districts at present known to our commissioners on diseases of domestic animals. We have found ignorance the means of spreading hog cholera, and knowledge the best

quarantine against it. Our supply of horses is mostly obtained from Vermont or the West. Very few raised in the county—only a few hundred; no general form of disease has prevailed, and few have died from any cause not incident to age. Litchfield County raises and exports many choice cattle for breeders, and working oxen, but imports a larger number of cheaper stock for fattening and for dairy. Milk fever, tuberculosis, anthrax or blackleg, and contagious diarrhea in calves have caused a few losses as usual; foals and abortion have continued to afflict individual animals or dairies, of course diminishing their returns. One or 2 per cent. would cover losses from all causes. Sheep husbandry has not advanced. We have had no disease that has come to my knowledge. The dread of hog cholera has operated with other causes to diminish to some extent the number of swine in the county, but there has been none the past year that has come to my knowledge. Most of our swine and sheep are raised in the county.

MIDDLESEX.—Hog cholera has never occurred in our county to any considerable extent. It has prevailed in some sections of our State, but I think where it has existed the infection has been brought in all instances by animals from other States. It is unquestionably one of those bacterian diseases highly contagious, and wherever it occurs the most thorough disinfection should follow. The general health of farm animals is good in this county.

NEW LONDON.—We have no hog cholera in our county that I can hear of.

TOLLAND.—I can not hear of a single specific case of hog cholera in this county. There are few deaths among swine, and these can usually be attributed to neglect in their care or quarters.

WINDHAM.—No hog cholera is reported as existing in this county.

DAKOTA TERRITORY.

BENSON.—I have not heard of a single case of hog cholera in this county, nor have I heard of a single case of glanders in horses. Cattle are in excellent condition at the present time and have not been affected with disease. Sheep are very scarce, and I have heard of no losses among the few we have.

BON HOMME.—Practically there is no hog cholera in this county. Perhaps \$3,000 would cover the losses among all classes of farm animals for the year just closing.

BUFFALO.—Three horses were found affected with glanders and were shot. Two animals suffering with distemper died for lack of proper care.

CAMPBELL.—No disease worth mentioning has prevailed among domestic animals in this county during the past year except a few cases of blackleg among cattle. Calves are more subject to the disease than mature animals. No remedy has been discovered; some regard saltpeter, sulphur, and coppers as preventives. As far as I can ascertain hog cholera has never made its appearance in this county. I have had considerable opportunity to observe hog cholera in its various phases in northwest Ohio. The disease is undoubtedly infectious, and isolation, quarantine, and "stamping out" are the most practical methods of prevention and far preferable to all so-called cures.

CAVELIER.—I never have heard of any hog cholera in this county. Horses, cattle, sheep, and hogs are in excellent condition and good health. Occasionally a horse is affected with glanders.

CHARLES MIX.—There never has been any hog cholera in this county. Hogs have been generally healthy, and do well here. There have been a few cases of glanders among horses, and five or six affected animals have been killed. A disease is affecting cattle in the county, but no one seems to know what it is. They die very suddenly.

CASS.—We have no hog cholera in this county or any prevalent diseases among either horses, hogs, cattle, or sheep, except glanders among horses, which exists to a considerable extent. The Territorial veterinarian was at my house last week and killed two of my horses, which he said had glanders. He is traveling all the time in the Territory, and has killed scores of horses since March 1, 1887. I have had hundreds of cattle, and have seen many more in a residence of ten years, but have never seen a case of anthrax, nor any other prevalent fatal disease among domestic animals of any kind. I am sure this will be the report from the entire county, except as to glanders. Think \$5,000 worth of horses have been destroyed by glanders in this county the past year.

CLAY.—No hog cholera has appeared during the year. I can not ascertain when it was first introduced. It was before I came to Dakota, eight years ago. It prevailed during the years 1885-'86, and the losses were very heavy. Farm animals generally have been quite healthy during the year.

CLARK.—Hog cholera is not known here. There never has been one case in this county.

DAVISON.—We have no hog cholera in this county. There are perhaps not over 5,000 hogs in the county.

DARLINGTON.—There is no hog cholera in this county.

DEUEL.—I can not find that any sign of hog cholera has ever been noticed in this or adjoining counties. Some of the hogmen say it will be here when we are crowded more with hogs.

DICKEY.—There is no such disease as hog cholera in this vicinity.

EDDY.—There is not a case of hog cholera known in this county.

EMMONS.—There has been no hog cholera or any other diseases in this county this year. Stock of all kinds have been very healthy. I have not a single case of disease to report.

FALL RIVER.—We have no hogs in this county, and very few farm animals of any kind. The few we have seem to be in a healthy condition.

FAULK.—We have had no hog cholera in our county. No disease of any kind has prevailed among our farm animals during the past year.

GRIGGS.—I have never heard of a case of hog cholera in our county. I have kept a couple hundred head, and my neighbors have from fifty to three hundred each, but there has been no case of cholera among them. My assistants report that they have never heard of a case. There is but little disease of any kind among farm animals, and they are generally in good condition.

HAND.—No hogs have died with the cholera to my knowledge. The county is new and there are but few herds of hogs of any size. No epidemic has prevailed among any class of farm animals during the past year.

HANSON.—There has never been any hog cholera in this county. A few animals died in 1886 by a disease which some farmers thought to be cholera. In my opinion it was not, as the disease did not spread, and this year, in the same locality, hogs are healthy. Hogs are very healthy as a general thing.

HAMLIN.—The diseases affecting horses, sheep, and hogs are so few and the losses so limited among these animals in this county as to hardly be worth considering. Blackleg once in a while gets into a herd of cattle, and some losses occur before the disease is arrested. The number of farm animals are about as follows: Horses, 4,420; cattle, 11,300; sheep, 5,000; hogs, 4,000.

HUTCHINSON.—The only hog cholera is on a few farms more noted for careless management than anything else. One farm in particular is an ordinary death-nest for all stock. Cattle and sheep are healthy. A number of glandered horses have been killed by State authority. The official did not have the confidence of the people; his judgment was questioned and the work was not thoroughly done. One horse near me was condemned but has not been killed.

JERAULD.—Hogs have been very healthy during the year, with no indications of hog cholera so far as I have been able to learn. There have been several cases of glanders among horses. The affected animals were killed. Blackleg has prevailed to some extent among cattle.

MCCOOK.—I have heard of no well-authenticated cases of cholera in this county. Hogs are remarkably healthy this season.

MERCER.—There is no disease among farm animals in this county. The cattle interest is the largest interest of our county, though there are parties now going into raising horses on a large scale. The most of the horses in the county now are ponies, which makes the average value small. A failure of crops last year caused farmers to dispose of about all their hogs. There are no sheep in our county. There has never been a case of hog cholera in the county.

MEYER.—There has been, up to the present time, no indication of hog cholera in this county. Hog-raising is just dawning upon the Indian's understanding as a profitable industry, and there is more interest being taken therein of late. The other stock raised in the county (cattle and ponies) have not suffered from any disease; in fact, there has never been, during my experience of sixteen years in the county, a better year for stock, up to the present time, but the remarkably heavy snow-falls since the latter part of November will probably cause considerable losses during the balance of the winter to those not abundantly supplied with hay or other feed for their stock.

MOODY.—No hog cholera exists in this county. All classes of farm animals seem to be free from contagious diseases.

MORTON.—No such disease as hog cholera has prevailed in this county. Never in the history of this part of Dakota were cattle, horses, and sheep in better condition than at present. This is the 12th of December, and our animals are getting fat out of doors. The so-called buffalo grass, which grows wild on our prairies, is very nutritious, and stock is doing remarkably well on it. Some time ago a disease similar to pleuro-pneumonia appeared in one of our neighboring counties, but the immediate killing of all diseased cattle checked the malady. The winter of 1886-'87

was very severe, and a great many hogs either froze or starved to death, consequently hogs are scarce at present.

POTTER.—Hog cholera is not known in this county. Glanders and nasal gleet have been quite common among horses. Fully 25 per cent. of the cattle of this county died last winter for the want of proper care. During the summer we lost some with blackleg.

RICHLAND.—Hog cholera does not prevail in this county. Out of 100,000 head in the county less than 100 head have been lost by disease.

SANBORN.—I have heard of no cases of hog cholera in this county during the past year.

SHANNON.—No disease prevails among hogs in this county. We have but few, and they are scattered over a wide extent of country. We have lost no animals by disease during the year.

STEELE.—Hog cholera has not yet made its appearance in this county. I myself have lost a great many hogs from cholera in the corn belt, and from observation I am satisfied that one of the principal causes of the disease is the universal feeding of corn. In this part of Dakota the food given to hogs is wheat screenings, barley, and oats, which make much sweeter meat than corn, and on which hogs remain extremely healthy. In the corn belt, when I fed oats with corn, my hogs were seldom afflicted with cholera.

TURNER.—No hog cholera in this county. No diseases among any of our domestic animals. Of course more or less die every year from old age, foaling, colic, overwork, etc., but no contagious disease is known in the county. In all new counties stock is not as well taken care of as it should be. Many farmers have no barns—only an excuse for one—yet the condition of stock in this county is excellent; never better at this time of year.

WALSH.—There is no hog cholera in this county. A few horses imported from the States have died of glanders, but owing to the prompt steps taken the contagion has been prevented from spreading. Stock of all kinds raised in the county has been exceptionally healthy, and I can not report the existence of any disease whatever.

WALWORTH.—I know of no hog cholera ever having prevailed in this county.

WELLS.—The disease of hog cholera is not known in this county. Three horses have been killed which were supposed to be suffering with glanders.

YANKTON.—It is about five years since hog cholera first made its appearance in this section of country. The origin of it is unknown. It just came. About five years ago was the first time that it occurred to us that this was a corn country, and consequently a place where hogs could be profitably raised. At that time hogs were few in number here, and people desirous of increasing and improving their herds sent East and procured stock hogs. Probably that is the way that cholera got into Dakota. Late importations have most invariably brought cholera. Those buying hogs promiscuously here have most invariably got the disease amongst their herds. More hogs died two or three years ago than before or since. Exclusive corn diet will probably produce it, while diversified feed will greatly diminish if not entirely destroy it.

FLORIDA.

ALACHUA.—Hog cholera was introduced about three years since. Hogs were healthy previous to that time. It seems to be more prevalent in the fall than at other seasons.

CLAY.—Hog cholera, which is now the terror of the hog growers, was introduced here about seven years ago by the shipment and distribution of "patent fertilizers." I do not know by which company, as several supplied this locality. Hogs that were turned into the fields where these fertilizers were used were the first to show symptoms of cholera, and from these it spread over the whole country, until now there is no place free from it. At present it is raging among the swine all over this State, and the probability is that the successful growing of swine on the great acorn-mast of Florida is at an end, unless a sure preventive can be discovered soon. I believe the above to be the correct introduction of the disease into this State. Swine that had died of the disease were used in manufacturing fertilizers which were shipped here, and the germ of the disease was not destroyed, hence it entered the swine here and was soon propagated through the aforesaid channel. Hogs are the chief stock of this county, but the past year has left only about one-fourth of the stock on hand. The cholera has destroyed about 70 per cent., balance from other diseases. Sheep have no diseases here, but the dogs and wild cats prevent a successful enterprise in sheep-growing. There is also a certain plant that is indigenous to this county in certain localities that is a deadly poison to sheep, and yet they will eat it when they come to it.

COLUMBIA.—A few of the “old timers”—the *ante bellum* farmers—believe that hog cholera is, or has been, an unquestioned verity in this county, and was introduced, or at any rate was first observed, in the year 1863. Although unable to tell whence it came, they agree that its ravages were chiefly, if not exclusively, confined to places where the hogs slept under houses and sheds in beds of stifling dust. While subjected to this inexcusable neglect numbers of them perish, but shortly after removal to clean, healthful quarters, and a diet of “grits,” coarse corn meal, or hominy with potash, the disease disappears. (I may state that the best-informed farmers, who have been here since 1866, with whom I have conferred, have not met with a single case of hog cholera.) There is still a very considerable mortality among hogs in this county, mostly in the spring, which can be easily controlled if the cause is as alleged by my correspondents, which, to say the least, is highly probable. It is this: After feasting all winter upon the rich gleanings of the pea powder and sweet potato fields, the hogs are turned out upon the “range” (wild woods) to “shift for themselves,” their owners say, which means to find an occasional acorn or root—or die, as most of them do. I trust and believe such a humiliating report as this can never be truthfully written of this county again.

DUVAL.—I can not learn that hog cholera has ever been in this county.

ESCAMBIA.—Most of the hogs in this county are raised in the range, and are not affected by any disease. The same may be said of horses, sheep, and cattle. I had some experience with the hog cholera in *ante bellum* times in another part of the State. Where hogs are raised in large numbers they are liable to cholera. I am certain that it is contagious. If one dies of the disease the others will eat the carcass, and all that eat of it will be fatally affected. But a small number of those attacked ever fully recover. I know of no effective remedy.

GADSDEN.—Hog cholera appeared, to my best recollection, in 1876, among imported stock and crosses, and since that time it has spread to all scrub stock. I notice it is more fatal among fat pigs. Some of my neighbors have lost some of their meat hogs this season. Hogs were generally healthy up to 1876.

GREENE.—We call every disease that attacks hogs, and they die in large numbers, hog cholera. The disease that prevailed in my county the past year was not precisely the same as the cholera of twelve or fifteen years ago. Not so many die now as then according to the number attacked. The disease last fall was more confined to pigs than to hogs of eighteen months and twelve months, although a good many of the latter died. The date when cholera first made its appearance is not known to your correspondent, but many years before 1860—probably forty or fifty years ago.

HERNANDO.—Hog cholera made its appearance in this county about ten years ago. Previous to that date no disease had prevailed among hogs. It did not do much harm for several years after its appearance, but the past year (1887) the fatality has been very great. Hogs are not pastured here, but roam at large in the woods, and of course with such free intercourse the disease spreads rapidly. No remedies are used, and the result is that many valuable hogs perish which might otherwise perhaps be saved. It is a popular saying and belief, not only among the Indians of Florida, but also among many of the whites, that black hogs have an immunity from almost all diseases that other hogs suffer from.

HILLSBOROUGH.—There has been no hog cholera in this county the past year. One of my assistants says: “I never knew a case of hog cholera until about three years ago.” It is generally conceded by my neighbors that it originated here among the camps of the working hands while the South Florida Railroad was being built.

HOLMES.—No cases of hog cholera have appeared in this section this year. The disease has prevailed here since 1883, and perhaps longer.

LIBERTY.—Cholera appeared in this county in 1876, and has killed a greater or less number of hogs every year since. Previous to that time hogs did well, although we raise them, or rather they raise themselves, in a semi-wild state. I do not know what to say in regard to disease of cattle, as our losses, though heavy, are to be attributed to want of care and feed in the winter season.

MADISON.—There have been but few contagious diseases prevalent among the farm animals of this county the past year. Some few cases of hog cholera have been reported.

MARION.—Hog cholera made its appearance in this county about the year 1879, and killed almost all the hogs in the county. During the winter of 1884 it made another clean sweep. Since that time hogs have been doing well. Previous to 1879 we lost some hogs by a disease known as thumps.

NASSAU.—We have had very few, if any, cases of genuine hog cholera this year. Many persons have hogs around their premises and give them very little to sustain them. The result is in spring and summer many die from lack of feed and care, and the cause is at once called cholera. Many sheep have died while in apparent

good condition. The cause has not been fully explained. The principal loss of horses has been caused from staggers, which is common among young horses in the summer season. Cattle have had no special disease.

ORANGE.—There are but few hogs raised in this county, and they generally run at large. I have never known a case of cholera among them.

POLK.—I have lived in this county ever since 1851 and can say that the health of hogs has always been very good till 1875, when the cholera very nearly swept out of our county the last hog in it. Since that time our hogs have not been bothered with any disease whatever.

TAYLOR.—Previous to the appearance of hog cholera hogs were healthy in this county, and it has never been seen in this (the southern) part of the county. In regard to the parts that have been affected, I can do no better than to quote from one of my assistants: "As to hog cholera, I never knew it to be in this county until 1884-'85-'86. In 1885 it played havoc, killing entire herds, not leaving seed in some places. The cause I can not tell. I tried several remedies, but none had any effect that I could see until I used assafoetida, sulphur, and salt mixed in feed. I do not know that it will cure; but I think it will prevent. I am of the opinion it is a blood disease. Some hogs will apparently recover and get fat, and they are not then fit to eat. They have smut spots and sores on them, perfectly black. I killed one this year (1887) that was a sight for any one."

GEORGIA.

BANKS.—There has been no prevalence of hog cholera in this county during this year. All classes of farm animals are in good condition, with no general disease prevailing.

BIBB.—Hog cholera first made its appearance in this county in 1850, and was supposed to have been introduced by hogs that were brought in on foot from some of the Western States. At that time all Western meat was brought here in that way. Frequently the disease will exterminate all the hogs on a plantation, while those on adjoining places will escape. It will often break out in several places at a time, separated from each other a distance of 4 or 5 miles. As a general thing, previous to the above-mentioned date, our hogs were free from disease. Pink-eye and staggers prevailed to a considerable extent among horses.

BROOKS.—Hog cholera has been very destructive in this county. No satisfactory remedy has been found for the disease.

BRYAN.—From the best information I can gather through my assistants and otherwise, hog cholera was first noticed in this county in the year 1873. It is not known what are its causes. Hogs before this time were generally healthy and prosperous, in fact unusually so. It would be of great interest to our people to find out its cause and a cure. Very often it will visit only two or three farms out of five or six in a radius of 10 miles—that is, the cholera will affect my neighbor's hogs 3 miles away and not touch mine, and *vice versa*. I have noticed a great deal of this in this county. The disease does not prevail this year.

BULLOCH.—Hog cholera was first noticed in this county about twenty-five years ago. Our observation leads us to conclude that the disease is caused almost entirely by lack of nutritious foods of more bulky form than corn, and by vermin bringing down the vitality of the animal, so as to make it an easy prey to disease. The disease can be prevented, in our judgment, by proper care of sleeping quarters and by providing a constant supply of a variety of foods, especially good grazing, etc. Horses, cattle, and sheep are healthy and in good condition.

CALHOUN.—Hog cholera has been known in this county a long time, and no one can tell when they first knew it or how it is propagated. Generally the hogs taking it are healthy and in fine, thriving condition. It appears almost without warning, and unless speedily arrested death is certain. It is communicated by contact in running together, and affects mostly the jaws of a hog. A correspondent has tried and recommends as a remedy "feeding soft warm food," or slops, bran, etc., as a hog can not "crack" corn when affected with the disease.

CATOOSA.—No disease worth mentioning among horses or mules. No disease in sheep worthy of report; once in a while one dies from accident or careless treatment in bad weather. Hog cholera is, in my opinion, largely due to want of proper pasture, want of change of diet from all corn, lack of regular salting, and careless treatment in general. It can be demonstrated that if they received the same careful treatment that horses and mules do, they would be as exempt from disease.

CAMDEN.—Hog cholera was first known in this county in 1875. Can not learn how it originated. Some think it was brought into the county by the purchase of hogs from vessels for the purpose of getting new breeds. Hogs were generally healthy previous to that time.

CAMPBELL.—Hog cholera first prevailed in this county as an epidemic in the year 1881. It was confined principally to the northern portion of the county, and all counties north of this suffered more or less. Since that time hogs have not been permitted to run at large in our county, and the disease has ceased to exist, except among hogs shipped from Tennessee, or those which have fed on the carcasses of chickens or other fowls that died with cholera. It is well known that all animals are made sick, and usually die, which feed upon these carcasses (man not excepted). It has been found that it will not do to ship hogs from the North to this climate. In future more stock of all kinds will be reared in this county.

CHATTOOGA.—There has been no cholera among hogs this year, or comparatively none. The disease appeared here during the late war, say in 1863, and is supposed to have been brought in by the shipment of hogs for the support of the Army. Previous to that time hogs were generally healthy, and were no trouble to raise. There has been some distemper among horses and murrain among cattle.

CLAYTON.—As to when hog cholera first appeared in this county I am not able to say. I will say, however, that the prevalence of the disease does not affect the raising of hogs here, as this is not a corn-growing county.

CLINCH.—Hogs in this county were very healthy until about the year 1875, when cholera made its appearance on one side of our county (the north), and traveled south very slowly until it reached the Florida line. It then appeared to move back slowly until it passed over the county, but missing some places. For the last six or eight years it appears in different localities, and spreads around, apparently, by the sick going among the healthy, or, what is more likely, the males travel from one neighborhood to another and contract and carry it to others. I know of cases where they contracted it abroad and carried it home, when the other hogs at home contracted it. It is very fatal, and the best means to arrest it is to kill and bury every affected animal. We do not know where it first originated or how.

COBB.—Our hogs have been remarkably free from cholera this year. I am unable to give the time of the introduction of the disease, or how introduced. So far as I can learn, though, hogs were generally free from disease up to the time of the appearance of cholera.

COFFEE.—Hog cholera was introduced into this county about the year 1858 by a lot of hogs driven in from the northwestern part of Georgia. Before this swine were generally healthy. A few horses are annually lost by staggers. A great many cattle die from starvation in the winter. Dogs and wild animals destroy a good many sheep. Some years cholera is much more destructive to hogs than others. This year the loss has not been very heavy.

COLQUITT.—Hogs have been dying from some cause in various portions of this county, but I can not tell whether the disease is genuine cholera or not.

COWETA.—Hog cholera made its appearance in this county before the war. Previous to that time hogs were healthy. Its ravages some seasons are more severe than others. A considerable per cent. die each year, and the disease is a severe drawback to raising hogs.

DAWSON.—As to the introduction of hog cholera into our county nothing is definitely known. The spread of the disease is generally checked by separating those affected and allowing them to eat of common tar in the trough. The tea made from green pine tops is said to be good. Horses have been but slightly affected with any disease, and the losses of other animals is mostly owing to the severity of the past winter and the little care taken of them by sheltering. But little attention is paid to stock-raising in this county, and but small outlay is made for improved breeds of the various kinds. There has been but slight loss the past season, as but few animals have been affected, except hogs, of which there have been some losses in almost every neighborhood. It has raged with variable violence ever since the late war, and as yet no reliable cure has been found for the disease. It generally attacks the best animals, of which about half usually die.

DECATUR.—Your correspondent learns from the oldest citizens that hog cholera was of rare occurrence in this section twenty-five years ago, if it ever appeared at all. Since that time new breeds have been brought from other sections and different climates. These new breeds seem to contract diseases before they become acclimated, and to communicate such diseases to the other acclimated hogs. Such breeds are brought into this section less frequently now than they were fifteen or twenty years ago, and hog cholera is becoming less prevalent than it was then. The losses are about 10 per cent. Horses are occasionally affected with distemper, and cattle with hollow horn. Sheep are healthy, but about 5 per cent. are annually lost by dogs.

DOOLY.—Hog cholera first made its appearance here about the year 1860. The means or mode of its introduction is unknown. Hogs prior to that time were very healthy, occasionally losing a few from need of attention. No remedy has yet

been discovered for the disease, or a preventive against its spreading. It is a contagious disease, but moves slowly from farm to farm. On some farms it does not leave a live hog on the premises. The disease is more fatal in the summer than during any other season of the year. On a close investigation I find that there are two varieties of the disease. One is an affection of the bowels, whilst the other is a cutaneous disease, the skin of the animal sometimes turning red, and at others of a bluish color. A disease called rot has caused some deaths among sheep.

DOUGHERTY.—Hog cholera made its appearance in this part of the State thirty years ago. At intervals since then it has appeared and prevailed with great violence, at times destroying almost the entire hog crop.

EARLY.—Hog cholera made its first appearance in our county in 1862, and has prevailed to a greater or less extent ever since. Its cause was generally attributed to the introduction of sorghum cane. It was discovered on those large plantations when sorghum was first grown. A few attributed it to the large increase in the number of hogs and the increased feeding, as provisions were the only things raised during the last two years of the war. More or less sorghum has been raised since, less now than at any time, yet cholera prevails in different localities every year. Your neighbor may have it this year and you may be exempt, but the next year it will be your turn and your neighbor escapes. There were a great many wild hogs in this county when the cholera first appeared. They soon disappeared, and there are none now. Before then a sick hog was a rare thing. They did well all the time.

ECHOLS.—Hog cholera has been in some localities of this county nearly all the time during the last two years, though the disease is not so fatal as it was several years back. Some hogs die, and a great many of them get well. I can not give the number that die or the value of the losses.

EMANUEL.—It is the opinion of my aids, as well as myself, that very few hogs die of cholera. It is noticeable that hogs that are not fed about the house lot, nor suffered to lie up in the lanes and around the lot and lanes, are pretty much exempt from cholera. Hogs in this county that stay in the woods and are fed there, and not suffered to come up and lie around in the lanes and dusty trash piles, are rarely diseased in any way.

FANNIN.—Hog cholera first made its appearance in this county in the year 1874. This was one of the last counties in the State to suffer from this disease of hogs. Its altitude and its remoteness at that time from railroads were causes of prevention. Since its advent thousands of hogs have died almost every year, amounting in the aggregate to thousands of dollars. I have, however, not heard any complaint of cholera this year.

FULTON.—Hog cholera made its appearance in the winter of 1845. The first outbreak was in a drove of hogs driven in from Tennessee or Kentucky, several of which died during the spring of 1846. A large number in the immediate neighborhood took the disease, one-half of which died. Hogs were in good condition when they took the disease.

GILMER.—There has been very little loss this year from hog cholera. It generally comes in its worst form every two or three years. I do not know how it was brought into the county. Hogs were generally healthy before the disease was known, which was about 1867. The only trouble before was what was called blind staggers and quinsy, a wheezing in the throat. When the cholera attacks hogs they take it in the mountains and wild range as well as on the farms.

GLASCOCK.—The disease known as hog cholera was not known twenty-five years ago in this part of Georgia. Its cause is unknown. There have been many conjectures but no reasonable conclusions arrived at concerning it. As to remedies, there have been many tried, but none found effective. When a hog takes the cholera it takes a disease that is incurable. If it happens not to die it is worthless, if it should live a year afterwards, from the fact that it can not be made fat. The only remedy is to prevent, if possible, the disease from infecting hogs. This may be done by giving them regular feed, pure water to drink, plenty of common salt and charcoal, and once or twice a month a small dose of sulphate of iron or sulphur, one or both. By attention to the above preventives some say they have never had a case of hog cholera.

GORDON.—One assistant writes that his first recollection of hog cholera was in 1865, after the introduction of so many improved breeds from the Northern States. It was known before the war. Another says all of his hogs died in 1856, of cholera (so-called). One assistant recommends soda as a remedy as well as a preventive. I know nothing of the disease. Have handled hundreds of hogs for thirty-five years. Have lost but a very few from what I am satisfied was cold or pneumonia. I use salt and ashes freely. They will devour the ashes and coal when in good health. For lice use kerosine oil freely, and they will have no cholera. The breed I have handled is the "Essex," the hog for Georgia.

GREENE.—The disease generally called hog cholera is very imperfectly understood among farmers, and nearly all diseases are included in this general term. Poor feed, imperfect care, and a slipshod way of tending stock generally produce disease.

GWINNETT.—Hog cholera prevails but to a limited extent in this county, and losses from it are hardly worth noting. Sometimes a few hogs die, and it is generally charged to cholera, when it is really from some other disease. So far as I have been able to learn, we have had no genuine hog cholera for several years past.

HANCOCK.—Hog cholera was not known here as a disease prior to the years of 1863-'64. Since then it has made its appearance almost yearly with greater or less fatality, and is generally confined to, or alternating, in localities or sections. The disease most generally discovers itself in the animal by loss of appetite, stupor, general flabby appearance, often attended with vermin in profusion. My observation is that hogs raised in forests and fed mostly on the mast till put in the field for fattening are free from all diseases.

HARRIS.—Can not ascertain when the hog cholera first made its appearance in this county, but think it was before the war, say about 1850. Some think the cholera is produced from sleeping under houses and inhaling dust, but often hogs, penned and fattened in open pens, have died with cholera while fat. There is much less cholera among hogs now than heretofore. Various remedies are used to cure and prevent it. The most universal preventive is to keep them from bedding and sleeping under houses, and mixing tar with their food. There has been but little disease among horses this year. But few sheep are kept, on account of destruction by dogs. Most all our pork is brought from the Western States, but few hogs being raised.

HART.—No hog cholera prevails in our county at the present time. The losses from disease among farm animals have been very light.

HEARD.—There has been no cholera among our hogs this year. Stock hogs seem remarkably healthy and thrifty. As a general thing, before hogs take the cholera they appear very dull and sleepy, and their eyes will run copiously.

HOUSTON.—The first case of hog cholera (so-called) that I ever heard of in this county was in 1867. Since then it has prevailed more or less every year. I think preventive measures are better than remedial. I had it on my place several years ago and tried almost every remedy I could hear of without any benefit. After burning all dead hogs, beds, etc., I got a fresh stock. Since then I have given them tar water to drink, scattering flowers of sulphur in their beds, and about once per month give them copperas and common soda. Since using these preventive measures I have had no cholera. I think lice have much to do in producing the disease. I never saw a cholera hog that was not full of them.

JACKSON.—We have more or less cholera among our hogs every year, with apparently no remedy within reach. During the last two years the number of hogs has been greatly diminished. Some farmers keep small numbers, but many none at all. We have had no unusual disease among any class of farm animals.

LOWNDES.—Hog cholera made its appearance in this county in 1865, just after the civil war. Up to that time such a disease was entirely unknown here. Since then it has made periodical visits, about once in five years, and has generally cleaned out the hog crop. No remedy has proved successful. It is contagious, and a hog that has got over it is never worth anything. They have been exempt from the disease during the past year.

MACON.—I never heard of a case of hog cholera previous to 1862. Since that time it has appeared in some portion of the county about every third year, though there are many exceptions to this rule. In 1876 I offered and had passed in our State agricultural convention a resolution offering \$500 reward for a complete cure for hog cholera. Various antidotes from every section of the country were sent in; all rejected, however, and the cholera still continues to scourge us. One great difficulty seems to be that it is almost impossible to detect the disease in its incipency, and when the hog refuses to eat the animal is in the last stage of the disease, and nothing can be done. To catch one and force medicine down his throat is slow business. Many believe that the disease is more prevalent after a fruitful acorn year. The plague with us neither spares age nor condition, the long-snouted piney-woods animal falling as easy a prey as the pet hog of the lot.

MARION.—In the year 1856 I lived in Lee County, 50 miles below here. I owned at that time 400 head of hogs. I made that year a fine crop of ground peas and sweet potatoes and the finest crop of corn I ever raised. I let pork hogs, pigs, sows, and all run on peas, and fed liberally on corn to hasten the fattening of my pork hogs. After killing all my pork hogs, which fattened easily and laid on fat better than I ever saw hogs before, my pigs, which were as fine and thrifty as I ever saw, began to dwindle, run off at the bowels, and in a short time out of over 100 not one was left. My six or eight months' old shoats, which were fat and fine, took the same disease and would die by the half dozen a day. I cut them open and found the lungs

black, and I then thought they had lung disease, but my old and experienced neighbors said it was pea disease brought on by eating rotten peas and pea roots. Up to that time I had never seen any disease among hogs except mange, and a disease brought on by eating cotton seed, which killed pigs and hogs that had nothing else to eat. I moved to Marion County in the fall of 1857, with an improved big Guinea stock of hogs—finer than the Essex, Berkshire, or any other breed I could find. They continued in perfect health until the summer of 1859, when one of my neighbor's hogs that were in a fine wheat, oats, and rye pasture began to die, and nearly all died, leaving three-fourths of the grain not eaten. After his had stopped dying for three or four weeks mine were still in perfect health, but had eaten out my pasture. He proposed to let mine have the run of his grass fields to finish eating the grain. In ten days my hogs began to die. They were similarly affected to his and nearly all died, although I took them out of his pasture as soon as they began dying. Their hair would slip and peel off just as if scalded; lungs black, intestines highly inflamed; discharged a watery, thin, jelly-like mass. I tried turpentine, soda, sulphur, salt and ashes, blue stone, and everything that was suggested—even calomel—but all to little purpose. Again, since the war, after I had recuperated my stock, and had them crossed with Essex and Berkshire and had them as fine-haired and sleek as race-horses, one of my neighbors had the cholera to destroy nearly all his hogs in the fall. They run out in the woods and intermingled with my stock hogs, which fact I did not discover until mine had the disease. It spread and killed all my pigs, three-fourths of my shoats, and I also lost several of my pork hogs. I killed all that seemed healthy, or probably I would have lost all of them. Symptoms were similar to those above described. Again, in 1883, I lost all my pigs and 40 or more shoats, breeding sows, and fat hogs; caught the disease this time from a negro tenant's hogs.

MCDUFFIE.—Hog cholera was here in 1850, brought here from Tennessee, and killed nearly all the hogs in the county. Since then we are troubled with it every few years. The best preventive I have ever tried is to keep a trough full of hickory ashes, mixing salt and copperas with it, where the hogs can eat of it every day. Let them have access to pure water, and give them a mash of wheat bran and corn meal, mixing spirits of turpentine with some once every week. I have used the above preventive and have kept my hogs healthy while my neighbors have lost all of theirs.

MITCHELL.—Cholera among the hogs of our county was not known prior to the year of 1863, when a gentleman, a farmer, of Alabama, near Eufaula, bought a plantation 6 miles west of this place, and drove some 50 hogs for slaughtering. Cholera was then and there introduced into our county, and has since that date prevailed to some extent nearly every year. Some years the per cent. of loss has been very great, say 33 $\frac{1}{3}$; other years not more than 5 per cent., perhaps making an average of 10 per cent.

MORGAN.—I have been farming in this county thirteen years, and have never known a genuine case of hog cholera to occur. Heard an old farmer of long experience say once that he never knew a farmer to have cholera among his hogs who raised goats on his farm. His idea was that the odor of the flock of goats acted as a disinfectant. I don't know whether there is anything in this or not, but he never had hog cholera among his hogs as long as he had goats, and I have never had a case of it, but I have had a flock of goats running with my hogs ever since I have been farming.

MURRAY.—Hog cholera made its first appearance here about thirty years ago. Since that time it has assumed different types. The first appearance was attended with scours; since then it has made its attacks in different ways—with fever, vomiting, and eyes red: they live a few days and die. Two years ago it visited this section and raged fearfully for a short time. Since then it seems to have died out. My opinion is that cholera is brought on by too sudden changes of feed. I have tried many remedies without any avail. I had one to get well without any medicine. All the outside skin peeled off. The mode of its introduction into this section is not known. It raged in Kentucky and Tennessee some time before it made its appearance in this section.

NEWTON.—We have had what is called hog cholera in this county for fifty years. No one knows how or when introduced. We now believe that hog cholera is produced from several causes. First, lice; second, sleeping indoors in dust; general neglect in food, water, and bedding.

OCONEE.—Hog cholera made its appearance about the year 1858. The means of its introduction are not known. Hogs were very healthy before its introduction. No disease was known among hogs previous to 1858.

OGLETHORPE.—Hog cholera is common in this county, and prevails every year more or less. Some years the loss is very great.

RANDOLPH.—Our people claim that cholera was unknown with us until about 1860, when the war broke out, and since then Pandora's box has been fairly opened, and poverty, hog and chicken cholera have been the heritage of our people. The best treatment we find for cholera is to feed 1 pound of soda to 1 bushel of meal to 10 hogs.

RABUN.—The cholera made its appearance in this county in the year 1865, and it has been more or less prevalent ever since. I think about one-tenth of the whole number usually die. It is only in parts of the county where the disease prevails. The county is interspersed with large mountains, and the hogs that range in them are entirely free from the disease.

PULASKI.—The first case of hog cholera known to the writer was about the year 1859. I think a little potash in feed is both a preventive and cure for the disease.

PUTNAM.—The disease known as hog cholera first appeared in our county in the year 1868, but from whence or how it came is yet unknown. For ten or twelve years it destroyed a great many hogs, but for the past few years, though it has visited several districts of our county, it has not been so fatal. Either it gradually wears out or the remedies used have proved efficacious in reducing its virulence and consequent fatality. Nearly all the remedies used contain alkalies of some kind—lime, soda, ashes, charcoal, spirits of turpentine, and kerosene oil are much used. Our county is now raising more hogs and pork than for ten years past.

SPALDING.—I never knew anything about hog cholera until a year before the war. It was very fatal then, killing out large herds. Those that kept but few hogs and fed them on slop lost none. We do not know what stopped the disease, as we have had but little of it for years.

TALBOT.—The writer commenced farming in 1843, and spent an average lifetime in that pursuit. Does not remember when he first knew of hog cholera. Never had any experience with it until about 1870. I know of but one remedy, and that is merely a preventive. The frequent use of pine tar will, I think, keep it off. The way my old negro used to do was this: He would take the tar bucket to the crib and smear the tar all over the ears of corn and feed it to the hogs. Then mix tar with lard and smear it over the hogs with a mop. This kept off the lice, and I thought cholera, too. At any rate, we did not have it when it was around us in every direction.

TAYLOR.—There have been some cases of hog cholera in this county the past year, but the disease prevails to no great extent now.

TELFAIR.—The cholera commenced here in August, and about 40 per cent. of our hogs have died. The first cases of cholera known in this county were brought here in the year 1860, which, I think, came from Tennessee and other places as imported stock. We find the native hog better adapted to this climate and country than any other, and we find it the case with other stocks. Stock-raising here is going down every year.

TERRELL.—I do not know how nor when hog cholera was introduced into this county, but do not think I ever heard of it previous to the late war. Before the war I remember having seen large lots full of the finest hogs in this section, weighing from 200 to 400 pounds, and great droves being driven from place to place, but never heard of any disease or deaths among them. I know of no remedy for hog cholera, though I have heard a great many. I notice that the hogs of those having a number of remedies die as well as the rest. During the past year very few hogs have died in this county. The coming year may be a very destructive one. Stock generally looks well throughout the county, with no prevailing diseases.

TOWNS.—Hog cholera made its appearance here about 1870, but it is impossible to find out how it originated.

UNION.—Cholera is the only disease worthy of mention which has at any time prevailed among hogs here. About 1870, I think, it first made its appearance. The virulence of the symptoms has gradually subsided, as well as the frequency with which the disease appears. There has been no cholera in the county this year as far as reported to me, and hogs are in fine condition. There have been no diseases among horses, cattle, or sheep.

WALKER.—The first appearance of hog cholera in this county is not settled, but the disease has made repeated visits after years of complete immunity. For several years past the epidemics that have prevailed differ widely from the true cholera. For the last three years the most destructive epidemics have prevailed, marked by symptoms of diphtheria, the first symptoms being an affection of the respiratory organs, cough, sore throat and eyes, high fever, afterwards with boils, purulent joints and other symptoms of putridity. No remedy has as yet been discovered. Bathing the entire chest with kerosene oil daily, and tablespoonful doses internally, gave the best results.

WARE.—Hog cholera made its appearance here in the summer of 1886, and about 50 per cent. of the hogs died. I succeeded in preventing the spread of the disease among my "Duroc-Jerseys," by means of feeding hot corn-cob ashes in their feed, and also carbolic acid, as recommended in the former reports of the Department. The carbolic acid seemed to have an almost immediate effect, but it became necessary to continue its use for some time after the appearance of the disease.

WARREN.—The first case of hog cholera was brought to this county in the fall of 1846 or 1847. About that time and before nearly all of the hogs were driven and peddled from house to house. Thus the disease was spread over the entire county. In a lot of several hundred thus driven most of them died, some before and others after purchase. From that date up to the present time we have been visited every three years with the disease. Last year the plague nearly stripped the county. This year we are again on foot with a fine crop for next year. We have found no remedy to relieve or cure them. We had no disease of the kind until about the date mentioned above. Have had no disease with horses or cattle. Poverty and want of care is about the only cause of losses. Of late our farmers are taking better care by providing shelter and good stables, and we go into winter quarters in good condition, with ample to feed on during the cold weather. Very few sheep are raised here.

WHITE.—During the current year we have been exempt from hog cholera. Last year and the year previous the loss of hogs by cholera was very heavy. No satisfactory treatment for it has been discovered. It almost always results fatally, and when the animal recovers from it it never seems to do well again. Stock of all kinds have been comparatively healthy during the current year.

WEBSTER.—Hog cholera made its first appearance in this county in 1857, resulting in serious losses during the years 1857-58, having during that time completely devastated the hog crop. In 1869 the disease appeared again with less violence, and in 1881 a disease which was, for want of another name, called cholera attacked the hogs. The first symptoms were: Partial and not unfrequently total blindness, followed with falling off of hair, loss of appetite and flesh; and, after lingering for weeks and often months, would die. Though one should escape it was ever after worthless. Various remedies have been used; none, however, has proven a specific. Hogs for the past two years have been freer from disease than for several preceding years; in consequence a much larger supply of meat will be produced.

WILKES.—Have heard of no losses by hog cholera worth mentioning the past year. My own convictions are that preventives are worth all the remedies. Green pastures—either native or cultivated grasses—clover, in absence of small grain, aided by salt, ashes, tar and soda in slops, and hogs will seldom if ever have cholera, so-called.

WORTH.—Hog cholera has existed here for thirty years. It is much worse some years than others. No remedy has been discovered for the disease. We are almost afraid to try to raise hogs.

IDAHO TERRITORY.

IDAHO.—There is no disease prevailing among the domestic animals of this county except scab in sheep and blackleg in calves. There is serious loss in sheep in the spring of the year, generally from scab. Blackleg usually attacks calves during the summer and fall months, and in a few cases has assumed an epidemic form. The past summer has been nearly free from visitation of the disease, except in some herds between Snake and Salmon Rivers. Horses are in fine condition and seem to enjoy almost entire immunity from disease. Probably there has never been a case of hog cholera in the county.

NEZ PERCES.—Hog cholera is unknown here. No contagious disease is prevailing among any class of farm animals.

ONEIDA.—Hog cholera is unknown in this county. There has been no disease of any character among swine.

WASHINGTON.—There never was a case of hog cholera in this county.

ILLINOIS.

ADAMS.—Hog cholera has prevailed in this county for many years, one correspondent says forty. Just how it first makes its appearance I do not know. Sometimes it seems to be epidemic, while at others it would indicate that it was only "catching" by coming in contact with one another. But my belief is that it travels in the air, and will in that way infect herds that are entirely isolated. There seems to be no known remedy. No treatment cures or seldom seems to even serve to check the disease. It has been among the swine of this county but little during the

past year. I can say there has been no unusual epidemic among any class of animals during the past year.

ALEXANDER.—I don't think there is as much hog cholera here as people claim. It is claimed that about every hog that dies dies of cholera. The disease prevailed to some extent last summer. Nothing is ever done for either hogs or cattle when they are attacked by disease. Distemper is the only disease that ever affects horses. Cattle have suffered to some extent by a disease resembling Texas fever.

BOND.—Hog cholera made its appearance here some twenty-five or thirty years ago, and has been in the county ever since. Since we have had a stock law and farmers have kept up their hogs, we have less cholera and a better quality of hogs. When hogs are well fed and have a dry place to sleep and plenty of water to drink, there is not much danger of their contracting disease.

CASS.—Hog cholera has been less prevalent this year than usual, and also less fatal. The disease is always preceded by lice on the hogs, a constipated condition of the bowels, and attacks of worms on the intestines. Where these conditions can be prevented no hog cholera or other hog disease will appear.

CLAY.—The disease known as hog cholera made its first appearance in this county in a virulent and epidemic form in about the year 1851. Since that time there has been periods of healthfulness with isolated cases of the disease, and again, there has been years when it appeared to be epidemic. But I think on the whole the disease is growing gradually weaker and less virulent in form, and at the present time there is no cholera in this county. My opinion is that there is no cure for this disease in its worst form; also, that it is contagious. I could verify these statements with facts, although I am aware they are disputed by some. The hogs in Clay County were never in better health than at present. I can give two good reasons for this (in my own opinion): First, the hogs are kept in smaller lots than formerly; second, corn is very scarce and they are not over fed and over heated with this kind of food. Four horses affected with glanders have been killed by order of the State officers.

CARROLL.—With the exception of hogs stock has generally been healthy. There is some cholera in the central and northeastern part of the county. On farms that have never before had it has made nearly a clean sweep this year and without any traceable cause. There is a rendering establishment in Savannah Township, at which hogs that have died of disease and other animals are taken and the refuse given to the hogs, and yet the owner recently published in one of our county papers that he had never had a case of cholera among his hogs. I don't remember what year the cholera first appeared, but the years 1877-'78 were the most fatal. No remedy has yet been discovered to cure or stay the disease, but I believe that could hogs be confined to soft or rain water there would be little or no cholera. It has been observed that there is less cholera in a wet than in a dry season, probably from the fact that they get more rain water. A disease called the quinsy used to afflict hogs before the advent of cholera.

CLINTON.—I can not state as to the year of the first appearance of hog cholera in our county. One of my assistants says that in 1872 was the first time he noticed it. I have had the disease on my place but once in thirty years. On that occasion it was brought here by what appeared to be a healthy young sow I bought from a trader, and found out when too late that she was the only survivor of a lot that had died with cholera. Many farms remain entirely exempt from hog cholera for years. There is little or no loss by the disease to small lots raised and fattened on the same farm. It is where large lots are indifferently picked up by feeders and fed exclusively on corn where the most damage is done, and that happens only when corn is plenty. This year hogs were fed on soaked wheat, chopped oats, and very little corn, and all inquiry fails to show any appreciable loss by cholera during the year. Experience (not theory) teaches that corn in large quantities is not good feed for hogs or horses, and should also be ground and mixed with other grain when fed to cattle or sheep. Wood ashes mixed with salt scattered on the feeding lot once a week, charcoal, slops of any description, clover pasture or roots of any kind seem to be preventive but not a cure for cholera.

COOK.—There have been no reports of losses from hog cholera this season. While the disease prevails throughout the country there are always more or less cases of incipient disease at the stock-yards in Chicago, and farmers and stockmen near by have learned by dear-bought experience that it is not safe to buy pigs or shoats at the stock-yards for feeding purposes. The malady has heretofore been brought into many neighborhoods by animals from these yards, but it has not established itself permanently in any part of the county. The disease is highly infectious, and has been carried considerable distances by prevailing winds; also by persons who had handled diseased animals.

CUMBERLAND.—I have not the necessary information in regard to the introduction of hog cholera into this county. It existed in the county before I became a

resident. As to the health of hogs previous to the introduction of the disease, I have been a resident of the county for sixteen years, and it was here before that time. Most all kinds of stock are well cared for in this county.

DE WITT.—It is very hard to determine what year hog cholera made its appearance in this county. I came to the county in 1859, and, as my recollection serves me, it was here before I came. How or by what means it was introduced I have no means of knowing. It is a queer disease. For several years at a time there will be none of it; then all at once, without any apparent cause, and with no premonition, it will make its appearance simultaneously in different parts of the county. Drovers on one farm will be affected, while on adjacent lands there are no evidences of it. Under this state of facts it is hard to determine how it is introduced. We used to think that stagnant water and mud caused it, but our theory was overthrown by its appearing during only one season among hogs that had clean running water in gravelly streams. We then concluded we could give no reason for its appearance, and still entertain the same views. We have lost a considerable number of horses; but our losses among these animals would not be so great ordinarily, but about two years ago a new disease was introduced here called *maladie du coit*. It answers in horses to syphilis in the human. Many mares were diseased. Some have been killed, others are lingering along, and some have apparently got well. There is a rigid quarantine against breeding or selling any of the animals that have been affected, in order to prevent the disease spreading. No remedy has as yet been discovered for the malady.

DOUGLAS.—There has been a small amount of hog and poultry cholera in this county this season. There was more in 1886, and they were very destructive in 1885. The silly talk indulged in by theoretical writers about dry, rolling clover pastures, pure spring or running water, timber shade, less corn, etc., is exploded by the experience of practical men whose livelihood depends on the success of the business. It undoubtedly exists all the time in a low form, is both contagious and epidemic. Whenever it appears in a new locality it will be found to be caused undoubtedly by contact with hogs from a cholera-infected region. However, I understand about all the States are infected now. No remedy of any known benefit, except to the vendor.

EDGAR.—Hog cholera first made its appearance here about thirty years ago, in 1857-'58. Hogs were healthy prior to that time. Those that take good care of their hogs never lose any by disease.

EDWARDS.—Hog cholera was first known in this county in the year 1855, the winter following the drouth of 1854. We raised no corn that year, and the animals had to live on mast, which we think produced the disease. Hogs were healthy before that time, as far as I have been able to learn.

EFFINGHAM.—Until within the last three months this county has been very exempt from the so-called hog cholera, and the opinion among the most of farmers is that hogs are unhealthy from neglect, from exposure to extremes of heat and cold, bad quarters, poor water (sometimes none at all that could be called fit for anything but a hog to drink). There never was so fine or so large a crop of hogs as there was the fore part of this last summer. There was no corn, and hogs were thrown on the market irrespective of condition, health, or price, and to-day finds this county almost destitute of hogs. There are some complaints of sick hogs, but none in this immediate vicinity. None of my assistants reported unhealthy stock of any kind. I can not call to mind one case of diseased hogs where they received proper attention. Hogs have been driven by hundreds from this locality to counties where corn is more plenty. They have been compelled to swim the creeks when full of ice-water, to sleep in old, decomposed straw-stacks, with only one-fourth feed. On arriving at destination they are turned to a crib of corn, so arranged that they help themselves. When the weather is warm the mud is usually one foot deep. Of course they overeat. Such cases have been observed the past fall, and out of a herd of fifty or sixty there would not be one left to testify to the bad treatment at the end of the first two weeks.

FULTON.—I came to Fulton County in 1854, but was only a boy at the time. Don't remember hearing of any hog cholera then, but from my own inquiries and those of my assistants, as near as we can gather information, it first appeared in this county about 1855-'56. Hogs seemed to be healthy before its appearance. No one seems to know or can give any satisfactory explanation of the date of its appearance. Strangles, a severe kind of distemper, has killed a good many valuable horses the past year. Cattle are occasionally fatally affected with milk fever, black-leg, and bloody murrain. Sheep are subject to scab.

HAMILTON.—The so-called hog cholera first made its appearance in our county in 1859, and has been prevalent in different parts of the county to a more or less extent since that time. On its first appearance the disease did not have the same

effect as it has now, I think. The disease now called hog cholera, from the symptoms, is lung fever. In the early stages of the disease hogs apparently sound and well would die within an hour, or at the farthest would not be sick more than twelve hours before death would intervene.

HARDIN.—My first acquaintance with hog cholera was in the spring of 1858, March, I think, of that year. This visitation extended into 1859, taking many fat hogs, and half of all the hogs of the county besides, and damaging many that were left. Again, in the winter of 1863-'64, it came very near cleaning out the country of hogs. Those two seasons were the worst we have ever had. My neighborhood has not been seriously troubled with it since the two first years. The bottom and low lands have suffered the worst. We have other diseases, called measles and blind staggers, which are as fatal on the ridges as the cholera. I have lost more animals by the blind staggers than by any other disease. I do not think I ever lost a hog with genuine cholera. My assistant, Dr. R. J. McGinnis, writes: "My first personal experience with and of hog cholera was in 1869, next in 1876, then again in 1885. In 1869 and 1876 the leading symptoms were vomiting and purging, and decomposition took place almost before death. This was not so in 1884-'85—vomiting or purging—but the reverse. First symptoms, failure to eat; then lameness in one or more of the limbs, especially the fore leg, swelling of fore shoulders with great thirst, scaly, mangy appearance of skin, sometimes shedding of the entire coat of hair. Recovery nearly always followed these symptoms in 1887. Do not think, from the best information I can get, that a dozen hogs died of cholera."

HENRY.—The parts of this county visited with hog cholera last year have escaped this season, but those parts not visited last year are having it now. The first visitation of hog cholera that I remember was in 1870, when a few herds were swept away. No one could account for the visitation. No amount of care seems to do any good. It may rage all round one farm, and the next year take that farm and leave the rest. On my farm last year the hogs all died but four. I buried the dead and bought more hogs in the winter. In the spring my hogs dug down to the dead ones and ate them, but have been very healthy this season. Many hogs have died from having worms. I think they can be cured by giving turpentine.

JACKSON.—Hog cholera made its first appearance here in 1859, in a lot of hogs owned by one man. He lost 75 per cent. of them. They were running at large in the woods, and were fed once a week on corn for the purpose of keeping them tame. The disease known as hog cholera has been making its rounds in the county ever since. My observation has been that more of them die in the spring and beginning of summer, and in the months of September and October, than any other time of the year. All kinds of remedies have been tried, but none have proved a satisfactory cure. I find separating the affected from the apparently healthy ones is the best remedy I know of. So far as known, previous to 1859 hogs were healthy in this county.

JASPER.—Less per cent. of hogs have died in our county the past year from the effect of cholera than on an average of the five preceding years. I could not give the date of the first appearance of the cholera in our county. My recollection is that it appeared as early as 1861, but not much damage was done until 1864.

JO DAVIESS.—There is no disease as a rule among the hogs that I know of. Once in a while we hear of a few sickly hogs, but nothing of a very serious nature.

JOHNSON.—Domestic animals in general have been healthy during the year. No loss to any marked extent except among hogs. The disease known as hog cholera has killed a great many hogs nearly or quite every year for twenty-one or twenty-two years past. I have not been able to learn the means of introduction of the disease into this county. The disease seems more apt to attack hogs which run upon the commons and along creek bottoms and swamp lands. The largest number of animals that die of this disease are pigs and shoats from one to six months old. There is no cure for the disease known to us.

KANKAKEE.—There is no contagious disease among animals in this county, except such as happens at all seasons and to all animals. There is no hog cholera in this county at present. It is not known when the first cases occurred. There were cases of the disease more than thirty years ago.

KENDALL.—Hog cholera has not been as severe in this county as in some previous seasons. I have heard of but one locality where it has been destructive. There are no special diseases prevailing among horses, cattle, or sheep.

LIVINGSTON.—Hog cholera has raged in some parts of this county while other parts have been entirely free from the plague. The mortality has been mostly among pigs under six months old. I have had no cholera among my hogs, nor has there been any in the immediate neighborhood, consequently I have had no experience with the disease. Cattle and horses are healthy, but the latter are in poor condition.

LAWRENCE.—Hog cholera made its first appearance in our county in the year 1856. Previous to that time hogs were healthy. The manner or mode of introduction is not known to your reporter. At the time of its introduction it was more fatal than at present. The disease is confined to a small territory this year and the deaths are mostly confined to shoats and pigs.

LEE.—Hog cholera has been among swine in this county, under different names, for many years. My opinion of its causes, deduced from long experience and observation, is in breeding and allowing too many to nest together in inclement weather, all causing loss of vitality. I think that if hog-raisers would take more pains to procure males not related to their sows, and were more careful in furnishing them with dry sleeping places on a good board floor, there would be a marked difference in the mortality of their herds. I have been breeding Chester Whites for the last twenty-five years; have been very careful never to have my breeding sows in any way related to the males, and I never have lost a hog with cholera, influenza, kidney worms, or any other disease, while my neighbors in many cases have lost all from cholera.

LOGAN.—So-called hog cholera was, to my knowledge, on father's farm in Sangamon County in the year 1859. It seemed to take its name from the large number of animals dying of the disease. One correspondent says it appeared in 1857, and was brought from Missouri by some parties who purchased there a large lot of stock hogs to follow cattle.

MACON.—Mr. George Young, of Argenta, Macon County, Ill., is one of our oldest settlers. He informed me that the first case of hog cholera ever known in this county broke out on his farm from amongst a drove of hogs brought up from Tennessee in 1860 or 1861, by who was afterwards the noted Confederate General Wheeler and his brother. These men lost largely of their hogs, and the disease was communicated to Mr. Young's hogs and he lost heavily. The disease still lingers here, and many hogs die annually from this cause. No remedy has yet been discovered that will effect a cure, and our people are as much in the dark with regard to preventives and cures as they were twenty-five years ago. All other stock are remarkably healthy--no serious losses known. Hogs were healthy in this county up to 1860, and until the disease made its appearance in the Wheelers' (Tennessee) hogs.

MARSHALL.—In many neighborhoods in this county hog cholera has been most destructive, in others not at all. Some roads are reputed to have been worse affected than others, *i. e.*, the farms on either side of the road. A local correspondent says that "some of the hogs on examination were found as sound internally as any healthy hogs." The rule has been that the entire herd goes when attacked, and often it is the herd of the most successful and careful feeder thereabouts. One of my near neighbors suffered the loss of ninety-five as fine Poland China shoats as I have ever seen. His neighbor just across the way—feed lots not 200 yards apart, both good farmers—has to date not been attacked. Let the "professors" crack that nut, if they can.

MADISON.—During the last two years there has been very little known about hog cholera. Three years ago there was a great deal of the above disease, particularly in the northeastern part of the county. Farmers lost in that locality in 1885 and 1886 nearly all their hogs, and those that survived were so badly affected as to be worthless.

MASON.—Horses and cattle have done well this year. Hog cholera has not yet prevailed. It is early yet, but some few cases are reported. From the best information I can get hog cholera was here thirty-five years ago, but then it was not known as such. Without doubt, it is caused to a great extent by overlaying and piling on each other in straw sheds and stacks, and hence it becomes more prevalent when cold weather sets in. We have not had any very cold snaps yet, but when hogs come forth from such nests in the morning steaming, smoking, and coughing, I do think it brings on this lung trouble called hog cholera.

MASSAC.—Hog cholera is supposed to have made its first appearance in this county about the year 1859. It was destructive on its first appearance, but seemed to be checked for several years, a few perhaps in each year dying. About 1875 was the most destructive season, as the disease was general all over the county that year. The best preventive measure is, when a hog dies with it to consume it with fire immediately.

MCHEMRY.—Hog cholera first made its appearance here in 1880. Previous to that time it was unknown in this county. It did not prevail to any alarming extent until 1886. It was supposed that perfect cleanliness and isolation was a sure preventive, but in the spring of 1886 the disease, as if dropped from the clouds, attacked some of our very best pens of hogs, not exposed in any way to infection, and every hog and pig that was attacked died. In the months of March and April last

the disease made its appearance in a few townships, but soon ran its course. I do not think that there is a case of hog cholera in the county at the present time. There is no known specific for the cholera that I know of; every remedy so far has failed. The assessor's returns show a great decrease in the number of hogs within a year.

McLEAN.—The first I knew of hog cholera in this county was in 1856. At that time we lost over four hundred head out of our herd. There are numerous opinions as to the cause of hog cholera—too numerous for me here to mention them. I myself thought at times I had discovered the cause, but I am well satisfied now that we as a people have not yet discovered the cause, and hence can not apply a remedy.

MENARD.—The first cases of hog cholera that I have any knowledge of were in the fall of 1864. I do not remember the year positively, but that is my best recollection. It occurred in some hogs shipped here from Missouri by Joel Dalby. Before that hogs were as healthy as any other stock. As well as I can recollect, those Missouri hogs were thin and were brought and unloaded at Williamsville, and put in the feed lot where there was plenty of feed, and soon sickened. This was the first outbreak of hog cholera we ever had in the county. Whether those hogs had it before they came here or not I never knew.

MERCER.—Hog cholera first made its appearance in this county in 1863, I think, and it was very malignant in form. As to its source or introduction I am unable to say anything. The disease has made periodical visits ever since, and has been a source of great financial loss to hog raisers of this county and State. It is the great drawback to hog-raising, and in many instances takes away all the profit of the herd of a single year, and often the profits of a series of years. As to managing the disease but little success has been attained, after the disease has got fairly under way. Hogs that have it once seldom have it again. Turpentine, kerosene, and soft soap have all been tried with favorable results. If fed before the hogs become sick they remain exempt.

MORGAN.—It is not definitely known just in what year the hog cholera made its appearance in this county, but it first became general in 1856-'57. The disease has since been very destructive at different periods. It has not increased in the last ten years. It is impossible to make any estimate of the losses, as there are other diseases which affect swine, and they are all called cholera. Some farmers refuse to make known their losses, while others give the subject no consideration. At least one-half the farmers never know how many pigs they own, and only make an estimate when the assessor comes, and this is always larger than the assessor's reports.

MOULTRIE.—Hog cholera made its appearance here about thirty-five years ago. Hogs were generally healthy up to that time. Occasionally some died of quinsy, but no general disease was known here. The disease seemed to be epidemic; did not go from lot to lot, but hogs isolated seemed to take the disease the same as those exposed. When a lot of hogs became affected the whole herd seemed to be affected to some extent. I have fed my hogs copperas occasionally for the last ten years when they did not seem to be all right, and have not lost one by cholera in that time.

PERRY.—Hog cholera made its appearance in this county twenty-five years ago or more. The number of hogs that died of cholera in 1886 was 3,000; gross weight, 121,570 pounds.

POPE.—The so-called hog cholera was first known in this county in 1858. It was said at the time to have come by progressive steps from distillery-fed hogs in Indiana. Hogs before that date were uniformly healthy, and no one thought of risk in investing in growing them. Since then there have been but few years that they have escaped the disease, and with varied losses. A great many remedies and preventives have been used, but with little or no success. Farmers now do not invest largely in that stock.

PUTNAM.—I can not tell the exact year when hog cholera first appeared in this county. I think, however, about thirty-four years ago. No person could tell how it came, but I well know that hogs were healthy before that time. For twenty years and over, from the first settlement of the country, hogs ran at large and were always healthy. No remedy has ever been used here with success.

SALINE.—Hog cholera made its first appearance in this county about the year 1857. The mode of introduction not known, but supposed to have been from distilleries in the State of Indiana. Hogs were healthy and free from disease previous to that time. We have not been seriously troubled with hog cholera for the last year, yet the disease has appeared to some extent in a few localities. All farm animals have been comparatively healthy during the past year. They came out of the past winter in low flesh but in good health. Owing to the drought of the early summer and fall stock of all kinds made but small gain in growth and flesh. Feed-

ing began much earlier this fall than usual. Stock has gone into quarters the present winter in good health but in thin flesh. Feed scarce, but sufficient to get stock through the winter with careful management.

ST. CLAIR.—Hog cholera first made its appearance in this county in the month of October, 1857. It appeared in a malignant form, carrying off whole herds. It has appeared in different parts of the county every year since, though the ravages some years have been entirely local and confined to the herds of a few farmers. To estimate the loss for one year, or for any period since the hog cholera first appeared in this county, would simply be guess-work. We have no statistical information to report from. No remedy for the disease has been discovered or introduced here. The intelligent hog producer depends on good sanitary conditions, green fields, pure water, small herds, and isolation from affected animals as prevention. Have no intelligence as to how hog cholera was first introduced. Only one farmer is reported as having cholera among his hogs in 1887. Hogs were healthy previous to 1857.

TAZEWELL.—There has been no contagious disease among horses, cattle, or sheep the past year. The condition of these animals is not as good as common, owing to the past dry season, but more pains has been taken to provide feed and shelter, so I think they will come out as well as usual in the spring. As near as I can learn hog cholera made its first appearance here in 1859 or 1860. Hogs previous to that time were in good health. Now, if a lot of hogs get sick from whatever cause it is called cholera, and it is the excuse for the owner who don't provide proper food and shelter. Farmers now, if the cholera gets among their hogs, save what survive and sell them, and then abandon keeping them to any extent for several years, until they feel sure the land has been cleared of the disease. I do not think any medicine will save them. That has been my experience. Most of the hogs that die of cholera are small, so the aggregate value is not very high. The best preventive for cholera is to keep your hogs in fields that are away from the highway, and not buy any (except occasionally a male), and not take any to the fairs.

SCHUYLER.—The disease commonly termed hog cholera, or the first infectious hog disease, made its appearance in this county in 1859. Something like 25 per cent. of the entire hog crop of the county died that year of the disease, the symptoms of which were altogether different from what is commonly called hog cholera now. Up to the time when the scourge first made its appearance in this county hogs were comparatively free from disease. Opinions differ as to how the disease was first introduced into this county. Some think it was imported, while others say it was spontaneous and epidemic in its ravages. The first symptoms at that time were loss of appetite, puking, purging, and what we called thumps, the evacuations containing millions of worms from one-half to 3 inches in length. Once affected the hog almost invariably died, then as now. None of the so-called remedies have ever amounted to a pinch of snuff, agreeably to my observation and experience.

SHELBY.—This disease of hog cholera first made its appearance in this county in 1874, and in localities where the most hogs were raised. Prior to that time our hogs were healthy, and such a thing as cholera was never dreamed of. Individuals, legislatures, and communities have investigated the disease and have arrived at the conclusion that unwholesome conditions in food, drink, and surroundings, with an epizootic influence added, is the cause. The most exciting cause is in keeping too many hogs in close or narrow quarters and compelling them to eat their food in mud and filth. Another is permitting them to run to old straw-stacks, where they get overheated and then get chilled while coming to feed. The best preventive is cleanliness in their surroundings. Corn fodder is better for litter than straw, for it does not heat so much. Plenty of pure water is a prerequisite to health. Last winter and spring the ravages of the disease were fearful, fully 60 per cent. of the hogs dying of it.

STARK.—The disease of hog cholera, or something called by that name, has prevailed to an unprecedented extent in our county this year. The generally accepted cause is the poor quality and insufficient quantity of water. It seems to be a disease similar in many respects to low types of fever in man, and hence is produced from similar causes. Hogs in large droves seem to be the ones that suffer the most. Many have lost all of their hogs. The disease seems to be abating now, but whether on account of the better water and colder weather, or because there are fewer hogs to work on, is difficult to say.

VERMILION.—My recollection is that hog cholera made its appearance about 1860. Previous to that time hogs were very healthy. The disease, I think, first made its appearance at distilleries in this and the adjoining State of Indiana, and from these spread out into the country. Owing to the extreme drought and want of grass livestock is thin in flesh. Many cattle went into winter as poor as cattle that roughed through out of doors usually are in the spring. There is enough rough feed to winter stock, but a great deal of it must go on to grass in the spring very poor, and some loss is probable. The loss of hogs by cholera the past year has been very small.

WABASH.—Hog cholera made its first appearance here in 1855. About that time hogs were running in the woods, and would peel most of the slippery elm trees and would eat the bark. Previous to that time hogs were healthy, except quinsy, which was not very fatal. Our shoats are afflicted with lung fever, which is very fatal among pigs from two to six months old. Some call this cholera.

WARREN.—Hog cholera made its first appearance in this county in 1860. Hogs had been healthy previously, except an occasional case of measles. Can give no account as to how it was introduced into the county. There is at the present time a large number of hogs in this county affected with cholera, but I have no means of ascertaining the exact number. The State veterinary surgeon, located at Alexis, in this county, in his last report to the State department, says: "There is no cholera among hogs that I have heard of." If he would only take the trouble to find out what is going on in other localities than his immediate neighborhood, he would find a large number of herds affected and dying off pretty lively.

WASHINGTON.—I have no distinct recollection as to the time when hog cholera first made its appearance in this county, but would say at least fifteen years ago. I can give no definite answer as to the mode of its introduction. Previous to its introduction, however, hogs were generally healthy.

WHITE.—I can not be positive as to the year of the first appearance of hog cholera, but it was not later than 1860. The disease came on to us from the eastward and came steadily on from farm to farm, as any other contagion would, which we are sure it is (have no doubt of it). I was an active hog raiser at the time, and well remember that when new it was far more fatal than now. Its first visitation left me 8 head out of 125 marketing hogs. I have often known men to lose the last hog of a considerable herd. Previous to its introduction hogs were quite free from disease; my losses did not exceed 3 per cent. The disease has prevailed to a greater extent in our county than others, as we think from the fact that we have a greater number of water-courses which carry the germs of the disease.

WILL.—There has been but little disease among hogs in this county the past year. Perhaps from 500 to 1,000 head have been lost by the usual diseases. Owing to the long drought the corn crop is very short.

WILLIAMSON.—Cholera has prevailed to only a limited extent among hogs in this county during the past year.

INDIANA.

ADAMS.—Hog cholera first appeared in this county about sixteen years ago. I can not say where it came from, but judge its cause came from improved breeds of hogs, as prior to their introduction hogs were healthy. I estimate our losses the past year at 23,164 animals, worth \$115,820.

BLACKFORD.—Hog cholera made its appearance between 1860 and 1864. Prior to that hogs were healthy. All diseases among hogs are now called cholera. Many hogs die from want of proper care. I lost about 25 this fall. The young ones vomited and purged, while the old ones only vomited. It is my opinion that lice and worms cause a large per cent. of fatality among hogs. There is very little complaint of diseases prevailing among either cattle, horses, or sheep.

CARROLL.—There was but little cholera this year among our hogs. Last year it was very bad. About twenty-two years ago cholera first made its appearance here. Hogs were healthy prior to that time.

CASS.—I have not been able to ascertain or approximate the time when the hog cholera made its first appearance in this county. The disease at some periods has proved very destructive, taking off whole herds. Some townships would be visited by the disease while others would not be affected at all. Then the following year the localities that had escaped the preceding year would be visited, while the townships or localities that suffered the year before would be affected but very little if at all. Then the disease would disappear for two or three years before revisiting the same localities. This year two or three townships in this county suffered very much, while other localities escaped. Hog cholera is not near as destructive as it was ten or twelve years ago, and if it continues to decrease as it has for a few years it will disappear entirely. There is no disease among hogs at present, but the lack of corn will cause a falling off in number of pounds of fattened pork. Hogs were generally healthy until the appearance of hog cholera, as near as I can ascertain. The disease does not affect the old stock of hogs, the elm peelers, as badly as the more improved kinds.

CLARK.—In my investigations I do not think the loss from hog cholera for 1887 will amount to 1 per cent., and I doubt if a well-attested case has occurred in this county during the present season. The loss of hogs the previous year was 1,922, about treble that of 1887, which I attribute to the oak and beech mast of 1886. The

bitter acorns of the red oak produce costiveness, and the wormy condition of the mast produces worms in the intestines of the hogs, which, no doubt, caused this great difference in the losses for those years. Hogs dying from thumps is caused by sleeping in the dust; costiveness is produced or brought on by various causes, from running on mast, impure or insufficient supply of water, etc. Every disease is called cholera. Some astonishing cures may be made with ashes, tar, sulphur, borax, copperas, blue dye, etc., in the meantime. If they have a sufficiency of pure running water, good range in summer, grass and stubble, are kept free from dust and fed corn and cob meal, oats and corn mixed and ground into meal, a limited amount of oil meal, bran a part of the time as a swill, and the slops from the kitchen in winter, hog cholera will be a thing of the past. Up to the breaking out of cholera it was generally considered that anything was good enough for a hog, and I am sorry to say many of our farmers, by their treatment of their hogs, are laboring under the above delusion yet. Hog cholera appeared in our county late in 1850, and confined itself to a very small area in and about Jeffersonville. It broke out in a very malignant form in some localities in 1862, and increased in territory until it visited almost every locality in the county in 1866. Gradually but surely it spread from the locality first mentioned, but up to this time I have never had a case of it on this farm, and I have had as high as 125 hogs feeding at a time in the same lot. The disease is said to have originated in this State—in the Aurora and Lawrenceburg distilleries. If the Department wishes and considers the history of hog cholera of sufficient importance (and there is no subject of more interest and importance to farmers of Indiana) it might send two or three men in the field to write up all the points attainable, having in view a history from the first outbreak up to the present time, and giving the views of prominent feeders and hog raisers on this important subject. Another correspondent writes: "I settled here in 1854, and know something about hogs. I find that for the first five years of my residence here, when stock ran unconfined, that general good health among hogs prevailed. As soon as improvement began, with inclosures generally small and unprotected, hogs began to die with what was supposed to be cholera. Isolation did not modify the disease, neither did distance exempt a man's herd. I know nothing of its origin, save that general inattention in the way of small lots or pens, mud up to their bellies—not a good spot in them, not a clean bite of feed or drop of good, sweet water to drink, and the worst of all, no good, clean, dry place to sleep. I give as my theory, that the above is the sole cause of the origin of hog cholera. There must of necessity be cause for the beginning of any and all diseases, regardless of its nature—contagious, infectious, or otherwise—and so I believe hog cholera was generated here by unfavorable conditions, and is both contagious and infectious; and now, since the disease regards not the best of attention, visiting herds almost regardless of conditions, yet I insist that it can be controlled. First, by good care, providing for comfort in every way; and, second, by keeping them away from the spores and parasites.

DECATUR.—Hog cholera was unknown in this county while the woods breed or elm peeler constituted the entire stock of hogs. About the year 1850 the Berkshire, Poland China, and Chester White breeds were introduced. Hog cholera soon appeared and has existed with more or less virulence ever since, but notwithstanding the havoc and loss from cholera among the improved breeds we would not think of returning to the original stock. It required two years to get the woods stock ready for market. The improved hog is fat from a pig and ready for market at any age. The symptoms and nature of hog cholera are so well understood it is not necessary for me to describe them. Various nostrums have been prescribed, but have proved ineffectual and heavy losses annually occur. Charcoal, ashes, and copperas are preventives. There have been no unusual losses among horses, cattle, or sheep.

ELKHART.—Hog cholera in bad form existed with us as far back as 1856–57. Previous to that time we had the old breed generally known as the elm peelers, or "third row" hog. There was no disease among them, except what was known as measles and kidney worm. In the first disease the skin bore red specks. It did not often prove fatal. In the second case the animal would circle round, could not go forward in a straight direction; would take a bite of feed and then turn round. This disease proved fatal in about every case. Cholera existed in the southwestern part of our county up to 1879. Since then we have had no disease of any kind in that locality until the present fall and winter. The disease covered an area of one by two miles. It seemed to take on different forms. My aid writes: "I had 9 sick ones out of 10. Their bowels were very much constipated; lost 1: gave them scalded bran and fresh milk. In fact, they would eat nothing else; others would vomit and have diarrhea. In a small district in the eastern part of our county they lost 15 or 20. Hogs in that locality do best in clean and well-ventilated pens. Will say that your reporter has been on this farm his life-time and since the time when there were more Indians by far in the county than white men, and I never lost a hog by the disease of cholera, and we have raised many hogs for the market.

FAYETTE.—Hog cholera has existed in this county for at least thirty years. How it came or where from I can not find out, but since its first appearance in the county it has done more or less damage every year. Sometimes one year in one locality, and perhaps that locality next year will escape, and it will break out in some other. No remedy has yet been found for the disease.

FOUNTAIN.—Hog cholera made its appearance about twelve years ago in our part of the county, and was very fatal, but of late years we have found a preventive if given in time, so that we have not been as unlucky of late years. Have heard of very small losses within the past year. Hogs, previous to twelve or fifteen years ago were, as a general thing, very healthy. I think probably it might have made its appearance as early as 1870 or 1872, not much earlier. A great many persons lost all their hogs in the early history of the disease. There has been from early spring foaling a heavy loss both of colts and mares in our part of the county, and a great deal of distemper or something that affected horses similar to this disease, but as a general thing has not proved fatal as at other times. A great many think it was brought about by the short supply of water, caused by the severe drought. There has been some epizootic, which still lingers, leaving the horses affected somewhat similar to the heaves, and a great many think that is caused by the dryness of everything fed. Cattle are in better condition than could be expected from the long-continued drought. As farmers have of late years been more careful of their cattle by preparing sheds and shelter from the storms, there has been very little disease in the cattle line. Sheep are looking fine. There has been no cold weather as yet to cause them to shrink, and very little disease.

HANCOCK.—Hog cholera, as nearly as can be ascertained, appeared in this county in 1857, but for a few years before there had been a disease similar to quinsy, which destroyed a great many hogs; it may have been cholera. Nothing is known of the means by which it was introduced. Of course there were various surmises as to its cause. The prevalent opinion is that it was caused by the exceedingly large mast of that year, and at that time hogs run at large all the year round, living mostly on mast, which consisted of oak, hickory, and beech nuts. Previous to that time (as far as I can learn) hogs were healthy, and were in a great many instances fattened entirely on mast.

HAMILTON.—The losses from hog cholera have not been as great in our county during the last year as the preceding one. I can not state what year hog cholera first made its appearance in this county, but it was as much as thirty years ago, and it is as much a mystery now as ever. How it comes and goes, or how it can be cured or prevented, etc., is what we would like to know. One time it will take all the young hogs, under say six months, while at another it will take the old hogs. It comes in all kinds of ways and all seasons. There is no general mode of treatment or general remedy. While the disease is regarded as incurable every one will use some kind of remedy, and may think it does good, but the next time some one tries it it is an entire failure. Prior to the advent of cholera hogs were generally healthy. Of course all hogs that are sick nowadays have not the cholera, but everything is called by that name. Horses, cattle, and sheep have remained healthy during the year.

HARRISON.—Hog cholera made its appearance in this county about 1840. We did not know any cause for it. Hogs previous to that time were healthy. Hogs that are kept up have been more liable to disease than those allowed the privileges of the range.

HENDRICKS.—In the absence of dates and figures it is hard to say when hog cholera first appeared here. But as I have had considerable experience with the disease, I would say it commenced in 1856 in some portions of the county. In other portions of the county it was ten or fifteen years before it made its appearance. It first appeared on the large water-courses or bottom lands, and from thence to the upland. It first appeared in large herds of swine. The first year the hogs run off at the bowels, but after that it seemed to be fever, sometimes in one form and then in another. My great losses have been occasioned by turning my hogs on wheat that was blasted. In ten or twelve days they would be attacked by contagious fever and would die in great numbers. My conclusions are, not to keep too many in one place, and when one gets sick take it out to the hospital and doctor it the same as one of your family when sick.

HENRY.—Hog cholera has prevailed to an alarming extent in this county for several (five to seven) years, but at just what time and in what manner it was introduced I have not been able to determine. The disease seems to have reached the climax and spent its force during the year 1886, and left the county almost destitute of hogs of any kind. Scarcely any left in any portion of the county for even breeding purposes. Some parts of the county have suffered slightly from the disease during the present year. At present I know of none anywhere. It seems

to disappear as the colder weather approaches. Cattle and sheep are healthy; know of no complaint anywhere in the county.

HUNTINGTON.—The first I ever knew of cholera was fourteen or fifteen years ago. I can not tell how it came here. It spread all over the county, and we did not know what it was. Since the above date I have watched it carefully. It starts generally from some weighing place, or from where the drovers stop over night with their hogs, and spreads by contact over the neighborhood. I knew a boar to break out and was gone some time, and finally came back with the cholera. I knew a sow to wander three miles from home and spread the disease. The last time I had it among my hogs it was caused by bringing a sow to my boar. It is often spread by not burying those that have died. Before its advent here hogs were very healthy. There has been such a change in the last twenty-five years in raising hogs that it has affected the animal's constitution. It used to be that a hog was wintered once before he was fattened. Now he is crowded on a corn diet from a pig, which makes him susceptible to cholera. The greater variety a hog has in his food the more healthy he will be; the older a hog is the better he can stand a corn diet.

JACKSON.—In several townships of this county hog cholera has prevailed during the year. The majority of the animals attacked are from four to six months old. The first symptom is a cough, followed by drooping posture of head; are disposed to lie down; refuse to eat; manifest great thirst. In the last stage preceding death dark spots frequently appear on the skin. The characteristics of this dreadful disease vary greatly. Where animals have plenty of fresh water and access to wood pastures the disease is less violent in its course and results.

JASPER.—Very little cholera among hogs in the county this year; less than for four or five years past. It was brought here by hogs shipped in from other counties.

JAY.—We hardly know what hog cholera is here any more. I do not think fifty head have died of the disease in this county during the year. Hogs were very healthy previous to the introduction of cholera, which, if I mistake not, made its appearance here in 1867-'68, and for eight or ten years after that time it was almost impossible to raise hogs. It has gradually disappeared, however, until the disease is almost a thing of the past. A few horses have died of pink-eye, but farm animals of all kinds are generally healthy.

JEFFERSON.—There is no hog cholera in this county.

JENNINGS.—During the past thirty years we have had three severe epidemics of hog cholera. It has invariably been produced by hogs coming in contact with diseased animals. A hog came to my place and died of cholera in a fallen tree top. My hogs, in passing by the dead animal, took the disease, and, although healthy before, I lost 70 head before the malady subsided. At another time—about seven years since—the cholera appeared in this vicinity. My hogs were healthy, but by drinking impure or contaminated water they took the disease and I lost 66 head of very fat animals. I have examined numbers of them, and am of the opinion that they generally die either of congestion of the lungs or of the brain. The symptoms of the disease greatly vary, however. With all the remedies we have tried we find nothing better than sulphur and carbonate of soda, given freely, with plenty of exercise. I think we have been too careless in breeding to immature animals. Old animals, on both sides, produce the strongest and healthiest pigs. Then, again, we raise too many together, and feed too much corn. If kept in small lots and given a variety of food they will generally remain healthy.

KOSCIUSKO.—The first appearance of hog cholera in this section was about seven years ago. Where it came from we do not know. However, it came into the county from the south. A great many hogs have died of the disease. Another correspondent writes: "I can not learn of any hog cholera in this county. There was cholera in the county south of this (Wabash) about a year ago, and a few cases on this side of the line, but it did not get any farther. I have not lost a hog by disease for twenty years, and know of no cholera during that time in this vicinity."

LAKE.—So far as I know this county has never been troubled to any serious extent by hog cholera. Some four or five years ago a few farms in one corner of the county were affected with a disease supposed to be hog cholera. It seemed to spread in from an adjoining county, but I have never heard of its breaking out on either side of the county line since that one fall. The production of horses is on the increase, that of cattle rather decreasing, while sheep and hogs remain about the same. A large number of hogs are raised, but very few sheep. No prevailing diseases of any kind have troubled domestic animals during the past year.

LAGRANGE.—No definite date can be given when hog cholera made its first appearance in this county; probably it was twelve or fifteen years ago. Prior to that hogs were generally healthy. Our hogs then were not as fine bred as at present—had

more range, plenty of forest to roam in, were not crowded for the markets as they are of late years. Farmers have become in too much of a hurry to fatten their hogs for market. My observation has been when corn is plenty and hogs high more cholera exists. I never had the cholera on my farm but once—that was when my corn crop was large and hogs a good price. I closed my hogs in a yard, hauled corn to them by wagon loads, and that before they were accustomed to heavy feed; the consequence was cholera. There is more danger in warm weather than in cold weather of over feeding. Since, I have fed carefully in the start, and no cholera has appeared. This year our corn crop is light, and there is no cholera worth mentioning. I don't think our fine-bred hogs are as hardy as the old Arkansas "toothpick" breed.

LA PORTE.—So-called hog cholera first became known in this county about twelve years ago. Nothing is known as to its mode of introduction; but as it had been raging in surrounding districts for some time it would have been strange if we had escaped. Up to that time hogs were comparatively healthy. Originally it seemed to affect the improved herds principally, but now it is like taxes—shows no partiality to common stock. Everything savoring of contagion or an epidemic, whether caused "by a dispensation of Providence," or absolute neglect of owner and filthiness of surroundings, is called cholera. Those using good pastures, with or without grain, with pure water and plenty of soot and wood ashes, are not very apt to be troubled seriously with cholera among home-grown hogs.

MADISON.—I have made considerable inquiry in regard to the origin and date of the first appearance of hog cholera, but testimony is so conflicting that I consider the period very doubtful. It is generally conceded that it originated in filthy quarters. Frequent changes of pens and feeding lots, with strict regard to cleanliness and sanitary conditions—such as pure water and varied diet—are preventives. All agree that before the advent of cholera hogs were not subject to any contagious disease. During the past season there has been but little if any cholera in the county. Hogs are now healthy.

MARSHALL.—Hog cholera made its first appearance here in 1866, and it has been here ever since, alternating about every three years. It has raged badly in the northern part of the county the past year, and is working southward. Some farmers have lost as many as 60 head in a single week.

MARTIN.—Hog cholera made its appearance in this county about 1857. Its mode of introduction is unknown. Hogs were generally healthy previous to that year.

MIAMI.—From personal knowledge of myself and correspondents, there has been less of hog cholera during the past year than for years previous. As to the time or origin of said disease in this county, we know not. Horses, cattle, and sheep are remarkably healthy.

MONTGOMERY.—Hog cholera has prevailed here more or less for fifteen years. The past two years it has been very fatal and widespread. I think 20 per cent of the hogs of the county have died with this disease. Strict sanitary regulations relative to quarters, including bedding, food, and water, have much to do with the health of hogs. In my experience (and I have fattened more hogs of my own raising than any man in this part of the county) I find variety of food, clean quarters, and pure water indispensable to successful hog raising. I fattened 150 head in one herd the past fall, and did not have a hog sick or refuse to eat. One of my correspondents writes as follows: "The year of the introduction into this county of hog cholera I do not know. I think the first cases of the disease were at Laughery Creek, in Dearborn County, Ind., about 1852. From that point it has gradually spread over the Northwest, and more or less all over the country. As to the health of hogs before the cholera, I think it was so good generally that the thought of a sick hog never came to mind. You might see a maimed hog, but a sick hog, never. That is my recollection as to the health of hogs from 1838, when I came to the State, until 1882, or after the cholera made its appearance." Mr. Breaks says the first appearance in this part of the county was about 1863. Sometimes a hog was lost by thumps, and occasionally a hog had kidney worms.

OHIO.—Hog cholera first made its appearance in our county about the year 1855, as near as we can fix the date. At that time a considerable number died on the creeks. Up to that time hogs were healthy. At the present time there is no cholera, or rather epidemic of it, among hogs in our county. At Aurora, Ind., hog cholera prevailed in 1851.

ORANGE.—We had no hog cholera in this county during the current year.

PARKE.—Cholera among hogs first appeared here about 1855. It seemed to have been introduced by bringing into the neighborhood a small breed of Berkshire hogs. Never heard of hog cholera until the introduction of this breed. The disease prevailed here during the past year.

PERRY.—During the past year there has been no fatal prevailing disease among the swine of this county. Some ten or eleven years ago we had among our hogs

a very fatal visitation of disease which people called hog cholera. It attacked nearly all, old and young, fat and lean, indiscriminately, and under all conditions. Probably this disease was rightly named hog cholera, but there are large numbers of farmers who will cry out "hog cholera" whenever their lean shoats fall with starvation by the roadside, where they have been turned by their unwise as well as unkind owners to enforce the injunction of "root hog or die." In my opinion not one-half of the hogs reported as dying of hog cholera ever have that disease. Indeed, it is not putting it too strong, I think, to say that two-thirds of the farmers deliberately invite disease to their herds by neglecting proper food, shelter, access to pure water, and other attentions necessary to healthy growth and profitable development. In the treatment of this subject, and in looking for causes, if we should neglect to cast an eye towards "in and in" breeding, in my opinion we would overlook a very prolific first cause of disease, not always hog cholera, but which is in some cases reported as such. Of "in and in" breeding I might give my own experience, but it would only go to confirm the fact that the learning of the times is correct, and then it would have the negative quality of being unasked. For myself, if you can give me preventive measures you will do me a favor. But when my hog is once seriously attacked by hog cholera the relief that I crave is for him to die speedily, for if he should recover he will not be worth anything.

RIPLEY.—No hog cholera reported as prevailing at present. It made its appearance here in 1863, but was of short duration and did but little damage. Since that time we have suffered no further loss from it. A few horses have died of pink-eye, and a few sheep have been lost by grub and foot-rot.

RUSH.—Very few hogs have been lost during the current year by cholera. No preventive that I am aware of has been used to secure this exemption. I think the disease is like epizootic in horses—it "just quits."

SR. JOSEPH.—I am informed that the report of the assessors for this county, made last spring, shows that the loss by hog cholera for the year 1886 amounted to over \$10,000. There has been some cholera this fall, but the disease has not been so prevalent or destructive as last year.

SHELLEY.—Cholera among hogs first made its appearance in 1856 in the distillery pens along the Ohio River, from which it spread throughout the country. Since that time we have had more or less of the disease yearly. Hogs are healthy in this county this year. There seems to be as much evidence against the theory of contagion in hog cholera in our experience as in its favor. We have found no remedy for the disease as yet.

SPENCER.—Hog cholera first made its appearance in this county about the year 1853, and was very severe—worse than it ever has been since. The disease of late is of a lighter form, although thousands die every year. The disease yields more readily to treatment than it did at first. Some farmers feed hogs by putting carbolic acid in slops or water, they think with beneficial results.

STARKE.—The hogs of this county have been tolerably free from cholera. About the first appearance of the disease, to any extent, was in 1878. There may have been a few cases previous to that time. As to how it was introduced is unknown. There have been occasional recurrences of the disease in a mild form since its introduction. There have been but very few cases during the past year. Previous to its appearance the hogs of this locality were very healthy. I presume there are but few counties in this State where hogs are as healthy as in this.

SULLIVAN.—Hog cholera made its first appearance in this county in 1859-'60, and has done more or less damage to the industry each year since. It came in immediately after the first advent of oat-rust, and many farmers thought the disease was caused by hogs eating oats affected with it; but oat-rust has entirely disappeared and cholera still prevails. So far as the treatment of hog cholera is concerned, all remedies have utterly failed. I have had the disease among my hogs many times since 1860, and have tried all the sure cures I could hear of, and if I ever saved a hog's life by doctoring it for cholera I don't know when it was, and I have quit trying to doctor altogether.

TIPTON.—Hog cholera, or swine-plague, appeared in this county about the year 1860, and has been very destructive ever since that time, more especially during warm, wet years, caused by the animals drinking from the stagnant pools of water. But when the land has been quite well drained this disease has become less frequent and destructive. In proof of this theory I have noticed that in extraordinary years, such as 1837, there has been very little swine disease, consequently we infer from these facts that swine diseases, such as cholera, malignant or typhoid fever, are produced by insects taken into the animal while drinking out of these stagnant cess-pools.

UNION.—Hog cholera first appeared in this county in the year 1862, as near as we can find out. Previous to that swine were comparatively free from fatal dis-

eases. There has been some scab among sheep. Horses and cattle have remained healthy.

VANDERBURG.—Hog cholera, to be noticed as such, first made its appearance in 1860, but for several years after there was but very little loss from the disease. In the spring of 1869 over two-thirds of the hogs in the county died with the disease. Your correspondent lost 125 in three weeks; since that time there has been little loss from cholera. Your correspondent has had very good luck with hogs, by giving them plenty of good, clear water, and all the charcoal and ashes they will eat, with once in a while a change of lot or pen. Cleanliness and plenty of wholesome food, with exercise, is about the best preventive of disease. Before our section of the country became thickly settled we had large range, and generally plenty of water. No one ever knew of hogs dying with disease during that time. It is supposed that cholera was introduced in this county by a lot of stock hogs shipped from St. Louis in 1859 and 1860, as no disease was in the neighborhood where the hogs were sold.

WABASH.—I think the first appearance of hog cholera in this county was in 1874. Where it came from I can not now tell, but it gradually grew worse up to 1876, and from that date to this has been almost continuously with us. Sometimes it is in one part of the county, while other localities may not have a case. For instance, last year you could not find one farmer south of the Wabash River but what had some sick hogs. I lost 150 head, large and small. The north side of the river, with a few exceptions, was exempt, while now they are having it bad, while we of the south have no cases to report. One year one kind of medicine will do good then the next year it will be of no avail. My own experience has been that we catch it about every three years. We are very careful in every way, but one trouble is, I think, we feed too much corn in the ear. I have lately changed to grinding oats and corn, two of the latter to one of the former, and make a swill and boil it one hour. What I boil to-day I feed to-morrow.

WASHINGTON.—A greater or less number of hogs have died in this county every year for the past thirty-five years. During the past three years the disease has been very general and very fatal. We do not know how it originated. Some of our best farmers; who were breeding pedigreed stock two years ago, have quit the business on account of the heavy losses sustained in their herds. Some of them lost the results of their labors in breeding up and improving their stock for half a life-time. This is very discouraging to stock breeders, and they are not likely to try their luck again. There are fewer hogs in the county now than for years past, on account of the great scarcity of feed. Stock hogs are now worth \$3.50, and but very few are to be had.

WARICK.—There has been a limited amount of a disease called "black tongue" among swine during the year in this county, but little complaint of cholera. I can not give the exact date when cholera first made its appearance among swine in this county; but for over twenty years it has made its inroads among them at intervals of shorter or longer duration. From the best information I can get, the long-nosed scrubs were healthier than hogs have been since the introduction of the improved varieties.

WAYNE.—Hog cholera first made its appearance in our county in the winter of 1857-'58. People believed then that only hogs fed on slop from distilleries were liable to contract the disease. As to the mode of its introduction, no definite theory exists among farmers. Hogs were healthy before the cholera made its appearance. The neighborhood affected by the disease one year has never been affected the following year. The disease may be extremely fatal in one locality, while another, immediately adjoining, may be entirely exempt.

WHITE.—The year in which hog cholera was introduced or first appeared in this county is unknown to me. When it now appears it comes unexpectedly—seems to arise spontaneously. It prevails much more extensively in the eastern part of the county, which is timbered, than in the western portion, which is prairie. It has never prevailed in this county as a very destructive disease. The writer has raised and fed hogs during the past twenty years, sometimes several hundred at a time, and has never had a case of cholera among them. His plan has always been to keep salt and ashes in troughs of easy access to the hogs, or salt in troughs and coal in abundance. Salt and coal will be daily eaten by the hogs, and in considerable quantities.

WHITLEY.—Hog cholera has been in different parts of our county, but has never spread to any alarming extent. Occasionally a herd gets affected, and in a few cases a number of the herd have died—say one-third to one-half—but in no case, as I can learn, has it spread to any considerable extent. One man near me had seven die last fall out of a lot of thirty-eight. The disease spread no further, although he had another lot of hogs on the same farm. I know of no remedy or preventive

except yard care, wholesome food, and pure water. I would put particular stress on pure water, and advise avoiding filthy wallows. We think hogs will be healthy if properly fed on wholesome food, have good water and a fair range, and a good place to sleep.

WELLS.—Hog cholera made its first appearance here in 1870, and there has been more or less of it ever since. The heaviest loss was during the last year, when 99 per cent. of the loss was occasioned by cholera.

IOWA.

ALLAMAKEE.—There has been no hog cholera in this locality for the past two years. This disease had its greatest run from 1878 to 1882, and since then has gradually disappeared. The loss amounted to 75 per cent. I have no facts or theories about the cause or treatment of the disease not generally known, more than such information as I have gained from the reports issued from the Department of Agriculture. My practice is, to separate the sick from the well and burn the carcass. Dry and comfortable quarters and healthy food for the well are important factors.

APPANOOSE.—Hog cholera was first known in this county in 1862. Since then it has been very violent at times. During the year just ended we have not suffered much; in fact, it might be said that in a general way we had escaped, as the losses have not amounted to a half of 1 per cent. On my own farm, from 1862 until the present time, I have lost hogs to the amount of thousands of dollars, and although I have spent a great deal of time and money trying to find a cure I am fully convinced that as far as known we have no cure. And as to means to prevent it, except by isolating the healthy animals, in my opinion, there is nothing reliably known. During last winter I lost 250 head that were following feeding steers in Audubon County, and spent the remainder of the winter, with the help of our State veterinarian, in seeking in vain for a cure.

AUDUBON.—All contagious diseases among hogs here are known as hog cholera. About six years ago this disease was first known in this county. The means or mode of its introduction is unknown. Hogs were generally healthy before that time. The mortality is increasing yearly. Sometimes it prevails among young shoats and other times among old hogs. In one locality the hogs will become stupid, eyes swollen to blindness, kidneys, after death, are found white and unnatural, one-half the melt decayed. In other localities the lungs are covered with matter on the external part of the lobes; have some cough; hard breathing; dung hard, dry, and black, and just before death it will be covered with matter resembling that on the lungs; other animals will take the scours, which it is impossible to check. In other neighborhoods the hogs take what we call the thumps. In some animals it is about the heart, while in others it is in the flank; in others the mouths swell so that they can not eat or drink. About 95 out of 100 die in every case when attacked. All kind of remedies have been tried with no success. In most cases the disease does not travel fast, but jumps about in different localities. Is no respecter of hogs in the pen or on large, good pastures, with plenty of clean water to drink.

BOONE.—Hogs have been remarkably free from the disease known as hog cholera for the past six months. I do not know of a case in the county during that time. Hogs are scarce; all have been sold that were marketable on account of the scarcity of corn. They were generally healthy previous to the year 1865. Since that time we have had more or less of hog cholera. The disease will abate for some months, then will break out in some locality and sweep everything before it until it seems to wear itself out. Don't know of any preventive or cure, although the county is flooded with cholera recipes, which generally fail to do any good when the disease once breaks out.

BUCHANAN.—I have no data as to the first appearance of hog cholera in this county. I have raised hogs here twenty-eight years and have had no trouble. Think pasture and timber range has prevented the general appearance of the disease, though the present year it is worse than ever before. Extremes of costiveness or scours are common in some herds. Either extreme produces death in a few days. I think herds following cattle are most diseased if confined in close yards.

BUENA VISTA.—Hog cholera has prevailed in this county, off and on, for the last twenty years, but no one can tell the cause or give a cure. A few hogs are now affected, but not enough to cut any figure in the supply.

CARROLL.—Hog cholera is a peculiar disease. It appears there are at least three different kinds of hog diseases. Some farmers lost nearly all of their hogs by cholera. The disease commenced about twelve years ago, and has raged more or less every year since. A large number of cattle were lost during last year by the disease known as black-leg. We have not had a single case this year.

CHEROKEE.—Hogs in this county were generally healthy previous to the introduction of cholera, which was several years ago. With the increase of higher grade animals there seems to have been an increase of the disease. Localities visited one season are often exempt the next. The animals are sometimes costive and sometimes the opposite. Those that have sores on the outside and retain their appetite often recover. Many remedies have been tried, but nothing seems as effective as charcoal and ashes when used as a preventive.

CEDAR.—From my own knowledge and information hog cholera first made its appearance in this county in the year 1862. Prior to that time hogs had been healthy. The cause of the disease is hard to determine. There are as many opinions as there are men. Clean sleeping quarters, plenty of salt in a trough in the pasture or lot, good water and plenty of it, and last, enough to eat, is my method with the hog or any other animal that I raise on the farm. I have lost some of all kinds of animals; have had the cholera, too, among my hogs. The disease exists at present in different parts of the county, mostly among shoats or young hogs. I should think the number of hogs lost by what is called cholera would amount to one-fourth of all the hogs in the county.

CERRO GORDO.—I do not think any contagious disease has prevailed among horses in this county the present year. Occasionally we lose a few cattle by a disease known as "black-leg," but I do not think the losses will, at any time, amount to one-half of 1 per cent. We had a little hog cholera in the eastern part of the county last winter and spring, but I think it has all disappeared.

CHICKASAW.—Hog cholera has not prevailed to any great extent in our county for the past year, and yet the disease has been among some herds of hogs, and possibly some have died from it. Many farmers are using "concentrated lye" in the slops, thinking it a good preventive of the disease. Hog cholera made its first appearance here shortly after the Colorado potato beetle made its first appearance among us—about 1865, I think. Some years ago the disease was so fatal that nearly every herd of hogs in the county was badly decimated with it, but for several years past only in localities has it prevailed to any extent.

CLARKE.—Swine plague, or hog cholera, first made its appearance in this county in the latter part of the year 1862, or the first of 1863. It was thought to have been introduced by a passing drove from an adjoining county (before the day of railroads with us), as that particular drove lost several of their number in a drive of 150 miles on the public highway, and from that time to the present it has been almost continuously with us. Sometimes it would be very destructive, and again for months it would seem to cease, and farmers would hope it would not recur, but it would again break out with renewed violence. Prior to that time there was no disease of any kind in our herds.

CLAY.—Hog cholera is supposed to have been brought here about the year 1874, by parties shipping from affected districts in Illinois and Wisconsin. A large number of animals have been lost by this disease during the past year.

CLINTON.—Hog cholera has existed more or less in this county for the last eighteen years. Previous to that time hogs were very healthy. At present they are a very uncertain kind of property. The only safe course is to ship them to market as soon as the disease appears among the herd. We have tried various preventives and remedies without any appreciable success. As a general thing, all kinds of farm animals are usually healthy and doing very well except hogs.

DALLAS.—The first knowledge I had of hog cholera in this county was in 1862. This was in the southwestern part of the county, among herds kept at the numerous grist-mills in that part of the county. The foundation stock of these herds were brought from Indiana and Ohio but a short time previous to the outbreak. About this time the law restraining hogs from running at large went into effect, which, I think, helped to aggravate the disease, as hogs that could roam the county at will seldom slept or ate twice in the same place. From the time of its appearance at the mills, as above stated, it began to break out along the streams leading from the mills down through the southern part of the county. From 1866 to 1868 cholera was very prevalent in the southern part of the county, while it was comparatively unknown in the northern part; but it gradually worked its way back from the streams until, by 1874, it was scattered pretty generally over the entire county. I think the water-courses the main agents in scattering the disease, while the dogs and crows come next on the list. Rats scatter it to some extent.

DUBUQUE.—If hogs were allowed more clover pasture and given soaked or ground corn, which is their principal food here, there would be less disease among them. There is scarcely any attention given to the health of swine until disease strikes in. Then there can be little done to save them, as the several remedies prescribed appear to have no effect. The farmers in this section are beginning to fatten their spring pigs the following winter, thereby avoiding the dangers of disease by keep-

ing them over another year. Large numbers of these animals died during the year of cholera or some lung disease. Horses, cattle, and sheep have continued healthy.

EMMET.—It is the prevailing opinion that there never was a case of hog cholera in this county, although there have been a few cases attributed to that disease. All classes of stock have been very healthy the past year. Calves receive better care than they used to, and black-leg diminishes accordingly. Calves that were allowed to run on the prairie until very late in the fall, and then after getting them fleshy were fed on grain, would frequently die with black-leg.

FAYETTE.—I have heard of no cases of hog cholera in this county during the past few years, nor of any contagious diseases prevailing among domestic animals of other classes. Several herds of hogs affected with some disease supposed to be cholera were reported several years ago, my own among the number. I lost about 40 head, but am unable to say positively how the disease was contracted. I think, however, it was from a neighbor's hogs. We have had no recurrence of the disease.

FLOYD.—Hog cholera first made its appearance here some six or eight years ago. Up to that time hogs had been healthy. Where it came from or how it originated is unknown. It was very fatal, more so than in any year since, although it touched only in portions of the county. Since that time it has touched here and there, but not every year. There have been some losses this fall, but generally not heavy. Hogs are usually well kept here. One of my neighbors met with quite a loss of hogs recently, and his neighbor just over the road lost some more, both being equally well kept.

FRANKLIN.—Hog cholera has visited this county several times since I have lived in it (twenty-one years), but in different parts of county in different neighborhoods. Sometimes it only visits a few farms. It is not known how it first started. It is pretty sure to kill nearly all young hogs that are exposed to those that have it. It has not visited this neighborhood for several years; has been on my place but once; then I lost 150 out of 170 head. My hogs were running on pasture at the time. One then broke out and got with a neighbor's hogs that were infected. My hired hand put it in the pasture with the others while I was away. My hogs commenced dying in a few days. Sometimes the hogs on a few farms will nearly all die, while herds on adjoining farms will not have it those years. Then perhaps other farms will have it, and the farm that had it first will not take the disease.

GREENE.—Hog cholera has existed here for the past fifteen years, and possibly to a limited extent prior to that time. Although farmers have studied its symptoms carefully, as yet no remedy has been found to effect a cure. The only safe method is to prevent its appearance by stimulating a healthy condition of the hogs. My own treatment to secure this is by feeding oil-cake or boiled flaxseed in the slop or water they drink, at least twice a week. I also feed oats with corn. By this means a healthy growth is stimulated, and disease is not liable to occur.

GRUNDY.—Hog cholera existed in this county as far back as 1872, and may have existed prior to that time. As far as I know, the disease did not break out again until 1879, in which year it was quite general throughout the county. The disease has shown itself in some part of the county each season the past five or six years. Nothing definite is known as to the origin of the disease, or its method of transmission from place to place, and no cure or preventive is known, as far as I know. There is no prevailing disease among other classes of domestic animals.

HAMILTON.—Hog cholera first appeared in this county in 1876-77. Prior to that date these animals were healthy, but there has been more or less sickness among them ever since. I think the disease is very like typhus fever in the human being, and is caused by poor sanitary regulations, such as keeping the animals in the same pastures, lots, and pens, allowed to wallow in mud and warm water during the hot season, and fed on corn continuously. When the feed is changed at stated times, and they are given pure water with carbolic acid, sulphur, and other purifiers, they generally remain in a healthy condition.

HANCOCK.—No disease of a fatal character prevails among any class of farm animals in this county. We have not heard of a case of cholera among hogs this year. In the spring there was some complaint about sows losing their pigs, but no one attributed it to cholera.

HARDIN.—Hog cholera broke out in May last, and never left our herds until cold weather set in in November. Our hogs are in a healthy condition at present. The loss from disease the past year was upwards of \$40,000.

HOWARD.—Hog cholera has never raged so severely in this county as to deter hog raising to any great extent. It generally appears in the fall or late summer, and as far as I can judge is superinduced hereabouts by the hogs being exposed to a chill caused by overcrowding. I have also noticed that costiveness from running on grass without any other change of diet will bring it on. I have used a preventive powder with benefit. I used to despair of a hog when it got sick, but with this

powder (which I am not at liberty to publish) I have hopes, especially with young pigs, so I am never without some of it handy. The first alarming advent of the disease was in the fall of 1882, when the practice began of shipping the carcasses by rail to be rendered into grease, for which purpose 1 cent per pound was paid. A few cases have come under my view this fall, mostly to be traced to exposure to a sudden cold snap.

JACKSON.—The first indication of hog cholera was in 1865. No general complaint until 1870. Since that time it has been gradually increasing, especially among young hogs. It generally visits two or three farmers in one neighborhood, and in the majority of cases it does not take all. A few hogs will get over it, but they remain poor, weak, and scurvy, and lose a portion of their hair. They are generally taken with a cough, and eat but little, and live but a week or two. I believe it is more a lung or liver disease than cholera.

JASPER.—There has been no disease of a contagious nature among the stock of this county at any time except hog cholera, so called, and during the past year this disease has not prevailed to the same extent as in some former years. The disease made its appearance about the year 1860-'61; do not know how it was introduced. Various domestic and patent remedies have been used without any apparent good results. I have found nothing so effective in ridding a herd of swine of the plague as to remove all the well hogs to some new place where they could have plenty of exercise; in fact I regard a compulsory exercise of the greatest importance; run them until they sweat, then keep them in a warm place.

JEFFERSON.—There have been no epidemic diseases among cattle, horses, or hogs in this county this year. No losses have occurred beyond those usually resulting from accident, old age, etc.

JONES.—The so-called hog cholera made its appearance in this county for the first time to any great extent in 1878. How it was introduced was a mystery then and remains a mystery yet. It has never been as bad in this county as reported in some other parts of this and other States. Some years in some parts of the county, and other years in other localities, it has prevailed, but it has never been prevalent all over the county the same season. The disease has been very fatal in some localities this year, but it has not been wide-spread. We have no cure. All animals attacked are pretty sure to die.

JOHNSON.—Hog cholera made its appearance here in 1859. Up to that time hogs were perfectly healthy. In most of the county hogs formerly ran at large and some of the finest hogs I have ever seen were thus raised, weighing, in many cases, from 500 to 700 pounds. The prevalence of cholera has caused most farmers to keep their hogs in small inclosures, generally without corn or feed during summer. A large number of farmers were new beginners and short of means. Whether this change of management had any effect in introducing cholera or not I am unable to say, but certain it is it came with this change. Other farm animals have generally been healthy.

LUCAS.—As near as can be determined the year 1872 was the year which marked the greatest loss of hogs by cholera in this county. It was claimed that the disease was imported by hogs brought here to feed. Since that time all diseases of hogs have gone by the name of cholera. It is now in this county, usually the season of freedom from disease among hogs on account of a limited production of corn. Hogs have had more range and less overfeeding.

LYON.—Northwestern Iowa, in which is this county, was first generally settled in the year 1870 or thereabouts. From 1870 to near 1883 hogs were remarkably healthy; then came rumors of disease and death, which continued for about three years. Then the disease disappeared. The disease came apparently from the east or southeast. The year 1887 has been a healthy one for hogs. So has it for all classes of domestic animals.

MADISON.—It is difficult to get definite information in regard to the first appearance of hog cholera in this county. It approached this State from the east, was some two or three years getting west of Des Moines River, then about one year reaching this county. Can not get any definite theory as to its introduction. It has prevailed to some extent ever since, sometimes very generally for a year or two and then almost disappears for some years, when it would again become very fatal. Previous to its introduction hogs had been very healthy. Farm animals generally have been very healthy the past year.

MARSHALL.—Hog cholera made its first appearance in this section in 1876, I think. No one seemed to know how it came into this section, but it apparently started all over this county at about the same time and many lost their entire stock of hogs; others lost from one-half to two-thirds. No treatment seemed to do any good. In some sections of the county many shoats are dying at present; other localities are exempt. Previous to 1876 hogs were entirely healthy. Some kind of a tonic or

regulator seems to have a good effect as used by many. Some use one thing and some another, and I am fully satisfied in my own case the effects have been good, as I have never lost any hogs to speak of.

MILLS.—Hog cholera is a terrible disease and is the hardest thing we have to encounter in the stock line. It is almost sure death to a herd when it gets a start. I think there is no cure for it. The best preventive I can find is to let the hogs have plenty of copperas, salt, and sal soda, and keep them clean. I wish something could be found in the way of a remedy.

MITCHELL.—What has been known as hog cholera made its first appearance in our county about 1880 and 1881, though many cases were only lung disease brought on by exposure. The past year has been the most serious of all, so far as extent and loss goes, and no remedy has as yet been found. Generally when it gets into a neighborhood nearly all the animals die. The consequence is a scarcity of shoats, and also a disposition to not stock up, hence in all probability a short supply of pork another year. Pasturage has been short most of the season, and yet stock of all kinds go into the winter in good shape. Very small losses on horses, cattle, and sheep; though few in our county, they have done well. Hog cholera is supposed to have been introduced by bringing in hogs from infected districts.

MONONA.—The disease known as hog cholera first struck this county during the year 1876. It was introduced from Harrison, the county south of us. The disease was nearly three years in spreading over the county, first striking my place in August, 1879. The losses over the county continued more or less until the years 1885, 1886, when it became almost continuous and unusual, our losses being very heavy. With the beginning of the winter of 1886-'87 the disease seemed to have spent its force and rapidly disappeared, and, with the exception of a few cases during 1887, we have been clear of the disease and our hogs have been doing remarkably well. Before the introduction of cholera swine with us were almost universally healthy, having no disease that affected whole herds at a time. Our losses were then confined to occasional individual animals. With the exception of black-leg, cattle have been visited with no destructive disease.

MONROE.—The disease of hog cholera has never come under my observation. I doubt if it has ever prevailed to any extent in this county. Cattle are thin but in good health. Glanders prevailed among horses in one section of the county, but there is none now.

MONTGOMERY.—I find that hog cholera has prevailed in this county for at least twenty years, and as these animals are one of our staple products we have tried hard to find out its origin and how to stop it. I find that our farmers have spent from time to time at least \$20,000 in endeavors to arrest the scourge, but without avail. From my knowledge of the disease I am inclined to think it comes from in-breeding. I have seen a lot of apparently healthy hogs get droopy and die inside of twenty-four hours. Our hog raisers generally say: "I will do so and so if hog cholera does not strike me." From that time on he goes on *hope* alone. Our losses for the past year will perhaps aggregate \$40,000. Other classes of farm animals are healthy.

MUSCATINE.—In some neighborhoods in this county hog cholera has been very bad. I have known some farmers to lose a thousand dollars' worth of hogs in one week. The disease was very fatal within a mile of my farm, on the east side, eight years ago, and within two miles on the west side about six years ago. It is not in my neighborhood now, but it still exists in other parts of the county. I estimate the losses from this disease for the current year at \$48,000. During the past quarter of a century I have reared and fattened a number of hogs every year, and yet I never had the cholera or any other hog disease on my place, and I have never "doctored" my hogs with medicine or preventives. Some farmers whose hogs have died were, I think, disposed to doctor them too much. I am of the opinion that *hogs fed exclusively on corn for several generations* are more liable to disease than those that have a variety of food and range.

PAGE.—Hog cholera has been the prevailing disease among swine in this county. Some farmers have had a good many sick but have lost none, while others lose their entire herd. No diseases prevailing among cattle or sheep worth mentioning.

POCAHONTAS.—Hog cholera made its appearance in this county in 1879, but at this time we are nearly clear of the disease.

PALO ALTO.—In 1880 there was considerable loss in hogs, and the disease was reputed cholera. It was confined to the southern part of the county principally. There has never been any disease in the northern part of the county. Since that time there has been an occasional loss, but I have heard men say they did not believe a genuine case of hog cholera had ever been in the county—more like quinsy. A few hogs have died this year of a throat disease. There were about 4,000 horses in the county last spring, and the increase is about 20 per cent. There were about

18,500 cattle at the same time, with 20 per cent. increase. Of sheep there were about 2,500, with 50 per cent. increase. Of hogs there were about 14,000 last spring, and an increase of 200 per cent. since. There were a few isolated cases of black-leg reported in calves.

POWESHIEK.—Hog cholera has been in existence in this county since 1860. Sometimes the symptoms are similar to quinsy; sometimes vomiting and purging occurs, and again inflammation of the brain is observed. Some think the disease is caused by worms; whatever its cause is, it is contagious, so much so that chickens contract the disease and die. The only successful treatment is to kill the diseased hogs and bury them, and change the lot or pasture.

RINGGOLD.—Hog cholera made its appearance in this county in the year 1862, and has prevailed since to some extent, some years being more prevalent than in others. Previous to that time hogs were comparatively healthy. As to the advent of the disease, I do not know how it came to the State. It came from the east and south. Hogs died in the county east of where I lived (Henry County) one year before it reached this county, where I lived at that time. Previous to that time we hardly ever heard of a hog dying.

SAC.—The disease known as hog cholera was raging in this county prior to my settling in this part of the State. When, in February, 1876, I came to my present place of residence, older settlers had already suffered losses therefrom. During the last twelve years of my observation the disease has been more or less destructive in various sections of the county. In 1884 and 1886 it raged terribly in my near vicinity and on my own premises. In 1884 I, and many in the southern part of the county, lost respectively three-fifths, three-fourths, five-eighths, and eleven-twelfths of our hogs, old ones as well as shoats. A few farmers lost even their last living "corn-shellers." In the central parts of our county it raged in that year just as badly. Thus it has been going on at spells, jumping in certain sections, retracing its path at another time and creating havoc over old ground again, whilst a few exceptional localities have remained entirely free from said fiend. Since I know but very little about veterinary surgery, I will not vouch that the diagnosis which I intend to give will be exactly correct. There are various symptoms of hog cholera: First, hogs seem to catch bad colds; they generally stand with a round-up back, and cough from three to seven minutes continuously in a loud, ringing sound, something like whooping-cough. Their lungs become affected, and almost as light, in proportion, as down feathers. They keep on losing flesh from five to twenty-one days and then drop dead. Others seem all right but are very slow to rise from their litter; they seem to be constipated, as all their excrements are coated with a film; these have an excellent appetite for swill or water. Others have symptoms of thick noses, sore eyes, dwindling-round walks (dizziness); others seem to have "rip-rap" quick consumption, as they die off in a few hours. All that have the disease in a malignant type, in either shape or form, are almost surely doomed. Occasionally hogs have the disease in a slight or milder form, where 50 to 75 per cent. are apt to get over it all right. But if this milder form attacks sows during their gestation the sows either sink their litters, or, if born alive, they will surely die from weakness or inability to sustain life. In 1886 I learned the last statement from observation, since from 180 pigs born dead or alive only one lived, and when it was one year old it was yet a stumpy, lean, and miserable being for its age. The cholera is raging at present in the northwestern part of the county, and a certain gentleman has lost about all his hogs (200 head). In other sections we hear nowadays of an exceptional appearance of the dreadful disease.

SCOTT.—Cholera among swine has not prevailed to such an alarming extent this year as during some preceding years. There are various opinions on the subject. One of my assistant reporters claims cholera is brought on by continuing to pasture on the same ground for an indefinite time, and that it would be beneficial to change every two years. My opinion is that hogs, as a rule, are fed too much corn at times and become constipated, after which they are attacked with cholera, and when once it gets hold of a herd it becomes contagious; consequently the loss is great. I think where the herd is large and the animals are kept in close colonies the death rate is larger than when kept in smaller droves. I keep usually 20 to 30 head, and never lose an animal. They run on pasture and come to the pen for slop. Another safeguard, in my opinion, is to keep hogs as much isolated from poultry as possible, for where fowls die with cholera and are eaten by hogs the disease is transmitted to them.

STOUT.—Hog cholera did not appear in this county until about two years ago, since when some animals have died each year, but not in great numbers. The older settled vicinities seem the worse affected by it. This is a new county, most of the settlement being within ten years, and many male hogs have been shipped in for breeding purposes. The disease may have been brought in this way, but I can not

trace its origin. Again, most swine have been confined to small lots and dry feed, without grass, few pastures having been prepared for hogs as yet. There have been a few cases of glanders among horses.

UNION.—Your correspondent has lived in this county continuously since 1869, has kept from 50 to 150 head of hogs all the time, and has had hog cholera but once—in 1884. Then lost over half of my young hogs, but no old ones. What appears to be a peculiarity of the disease in late years—grown hogs seldom get it. There is no known cure for it when it has once taken hold, but preventives are freely used, and with good effect sometimes. It appears to be on its travels all the time, in one neighborhood this year and in another next, and is undoubtedly carried round the same as any other contagious disease. About all the corn raised in this county is fed to cattle and hogs—70 per cent. to hogs. The disease has not been very bad in this county this year, but it still lurks around and breaks out, but not in a general way; still enough to deter some from keeping as many hogs as they otherwise would.

VAN BUREN.—Hog cholera made its appearance about twenty years ago. I have no means of ascertaining how it was introduced. Up to that time hogs were generally healthy. There has been no cholera among hogs for the past five years. The health of these animals for the last year has been very good.

WOODBURY.—The same qualities that produce pauperism produce hog cholera every time. Dirty yards, dirty water, dirty food, carelessness, want of room, unequal and irregular feeding, dirty, wet bedding, and last, but not least, want of common sense. Hogs are grazing and rooting animals naturally, and whenever kept in small, hot yards will suffer. My experience has been that a change of food in any direction is a great help. If the herd looks sick open the gates and let them roam at will. If they still look badly burn some old bones and mix with linseed meal and water, which will set them all right. If this had ever failed I should not dare to write it, but seven years' experience without a single death from disease, though surrounded by dead and dying herds every year, have confirmed my above-written experience.

WORTH.—Hog cholera was unknown in this county until three years ago. At that time a grain and cattle dealer imported a car-load of shoats which turned out to be infected with hog cholera. He traded them to farmers in the county for fat hogs to ship, and so infected all stock and yards that they were sold to, and thus spread the disease more or less through the county. It is here now, spasmodically, more or less all the time. I estimate the loss in the county during the last three months at 200 head, and the value at \$800. They were mostly small pigs. The loss is not so much in the number of hogs as it is upsetting our calculations. At present I know of its being on five different farms, and it has generally swept the yards clean. I do not know that the farmers do anything to prevent the disease. Horses, cattle, and sheep are healthy,

KANSAS.

ALLEN.—The first hog cholera known in this county, as near as I can learn, was about twelve years ago, and came by cattle feeders going to the stock-yards in Kansas City, Mo., and shipping in stock hogs. Since then there has been more or less every year in different localities. One of my correspondents, living in the eastern part of this county for more than twenty years, says there has never been any cholera in that section. I think I have never had a case of it on my farm in a residence of thirty-one years.

ANDERSON.—So far as I can learn, cholera was introduced here in 1883 by hogs shipped in from Kansas City. Has been some cholera in northern and southwestern part of county, but none the past year that I know of.

BARTON.—There has been no hog cholera in this county this year. It was brought to this county a year ago from Missouri in a lot of stock hogs. Native hogs seem to be free from the disease. Hogs are generally kept in small pens in summer, and run at large in winter in the corn, wheat, and rye fields, and are fed when they come up.

BOURBON.—The ravages of hog cholera have been comparatively light during the year 1887. As to the time of introduction in this county, I can not arrive at that date, as it breaks out periodically every few years, and rages with more or less virulence.

CHAUTAQUA.—There has not been any disease of any kind among any of the animals of this county for the past year. The farmers have generally changed from cattle industry to that of horses, owing to the low prices obtained for cattle.

CHASE.—This county does not seem to be troubled with the dread disease of hog

cholera. It is generally believed that good, well-drained quarters, and good, clean water to drink prevent it and pay the farmer well to provide them. Horses have extra good care. Oats, which are conceded to be beneficial to the horse's health, are fed largely. The feed of cows is mixed with roots and rock salt. Sheep are not handled to any great extent.

CHRYENNE.—Ours is a new county, and up to this date our hogs have not been affected to any great extent with cholera. In fact, I doubt if we have had the disease at all. Hogs do very well here, and if there is any cholera prevalent among them when they start for this county it disappears before they reach here. Perhaps the losses from all causes will reach \$3,500 for the current year.

CLAY.—Hog cholera appeared here in 1880, and was brought into the county by the importation of diseased swine. It has been raging here more or less since that time. There is less of it this year than I have known since its introduction. It is not a uniform disease, and deserves another name. It attacks hogs in various ways—some in the bowels and some in the flesh. Of course it is a contagious disease of some kind.

CLARK.—Stock of all kinds is absolutely free from disease, so far as I know, in this county. Occasionally some animals die from accidents, but there are no epidemic diseases, so far as I can learn. Stock of all kinds is in good health and condition. There has not been a single case of hog cholera in this county that I ever heard of. It has not reached us yet. In regard to the history of hog cholera, I can say but little. I feel quite certain it is caused by parasites, and these have the power of rapid multiplication. Some think the virus is carried from one to another through the air. I think it is more probable it is deposited by one and taken up by another, and when the disease makes its appearance the best remedy is to remove the well ones from the diseased to remote and clean quarters, and thoroughly disinfect the pens of diseased animals before again using them.

CLOUD.—As far as I have been able to learn, hog cholera has been in this county since its first settlement. I think the principal cause of the disease is a want of attention in regard to sanitary conditions. I have raised hogs for twenty years almost continuously, and have not suffered any loss to speak of, and I have handled thousands. I have been on my farm here in Kansas for eighteen years, and I don't think I have had the cholera on my place. My neighbors have lost almost all their hogs quite a number of times. I have a receipt, if used when the cholera gets into my neighborhood, that keeps it off to some extent, I think. Perhaps we have lost more cattle from feeding on stalks than we did last year.

CRAWFORD.—I do not know when hog cholera first made its appearance in this county. I have not heard of any prevailing disease among farm animals.

COFFEY.—Hog cholera first made its appearance in this county in 1875. It was imported from the St. Louis stock-yards in that year, and again in 1885 from the Kansas City stock-yards. Hogs are always healthy here unless the cholera is imported. Burned corn always stops cholera, and hard freezing weather in winter always prevents its return in the spring.

DAVIS.—I can get no official report of number of hogs lost by cholera. Farmers having the disease among their hogs say as little as possible about the matter, for fear it will affect their sales. But I am satisfied there is less of the disease here than last year, and our State law is so stringent that it tends to keep the disease from scattering, by obliging owners to burn or bury within twenty-four hours after their death. Cholera was first introduced into this county in the winter of 1881-'82, by shipping stock hogs here from Missouri. No losses by contagious or infectious disease ever occurred previous to that time.

DECATUR.—A very few hogs died of a disease called by some cholera last summer. They were the only cases since 1885, when some hogs from eastern Nebraska brought it here, and a few died.

DOUGLAS.—Hog cholera was at its worst in this county in 1884. The first diseased dead hog known floated down the river and lodged on a sand bar, and from this the disease spread over the county, and has not entirely disappeared since. It is worse this year than it was last. A large number of horses throughout the county have recently been afflicted with a disease which the veterinarians call aphthous fever, a breaking out in the mouth, which continues to grow if not attended to, rendering mastication very difficult. The doctors pronounce it contagious. Several horses have recently died with the complaint.

ELLIS.—A very few young cattle have died of black-leg. No hog cholera in the county. Sheep are healthy. The sheep industry is on the decline, as farmers can not afford to raise sheep at the present price of wool. Glanders and farcy are quite prevalent in some parts of the county. There have been six or eight deaths the past year from those diseases. There is a great deal of criminal carelessness with the owners of horses so afflicted, in using them with others, driving them to town and

hitching at public hitching posts, where all the horses of the county are tied. The wonder is that there are not more afflicted with the disease.

ELLSWORTH.—The first appearance of hog cholera occurred in 1883. It has never been as destructive according to the number of hogs in this county as in many other counties. As to its introduction, all we know is it came. Hogs previously were usually healthy, and have been since. I hear no complaint from feeders in relation to any form of disease among hogs or cattle. Cold weather of a severe character has caused the loss of some cattle and hogs, otherwise we would have gone through to this writing safely.

FORD.—Hog cholera has been very bad in this county in former years. We think it was shipped in here from Missouri. We know of no cure. I have known 90 per cent. of a herd to die of the disease. Horses and cattle are healthy.

FRANKLIN.—There was some so-called hog cholera in this county as long ago as twelve years, but where it came from, or how it originated, we are unable to state. The county has not suffered very much from that disease. There has been little or none of the malady for the last year.

GOVE.—There is no hog cholera in this county. I have lived here nine years and have not heard of a single case. I have raised a few hogs every year, and there has never been any disease among them. Cattle and horses are very healthy, indeed this county is a very healthy one for all kinds of stock.

HARVEY.—There is some little hog cholera in our county yet, but not very much. Hog cholera was brought to this part of Kansas about four years ago by shipping hogs in here from Missouri to feed, and for a time it did considerable damage, but it has been getting less in our county for the past two years, and will (we think) soon be a thing of the past. The total number of hogs I give you were in our county the 1st day of last March, and the number of dead ones also. These are the only statistics I have to work from, and you will see the losses are very heavy. This estimate being made at the close of winter, these losses cover all the winter losses of winter pigs from exposure, poor treatment, cholera, and everything that could be enumerated to destroy them; but a very small portion of them died from disease. There is no prevailing disease whatever among horses, and the mortality among them was principally old, worn-out ponies and some old domestic horses, with an occasional weak colt that could not stand the hardships of the winter. The greater part of the losses among cattle were caused (last winter) by turning cattle into stalk fields, and the greater part of the lost were calves and yearlings, mostly calves. No prevailing disease. Some sheep died of scab, some old ones died because of weakness and poor care, and a good many winter lambs died by not being properly cared for.

JACKSON.—I have been in this county eighteen years, and have had no cholera among my hogs, nor have my near neighbors been troubled with it. Two years ago a cattle feeder four miles from here bought some hogs of a hog dealer in St. Mary's, Pottawatomie County, Kans., and let them run with his cattle. A great many of the hogs died with cholera. The hogs on the farms adjoining this feed lot took the disease and many of them died. The carcasses were either burned or buried. The disease did not spread very extensively. This is the only time that I have ever known of any cholera in the southwestern part of Jackson County. It has been very extensive and fatal in some other parts of the county. I am not informed as to the year of its first appearance in the county.

JEFFERSON.—Hog cholera first made its appearance in this county six years ago in different localities. It is supposed to have been brought in by hogs shipped from Missouri. For a time it seemed to be confined to farms along the streams or creeks, but it has since spread all over the prairies and uplands. Some sections of the county escaped for years, but during last summer and fall it was very fatal in those sections. About one-third of the full-grown hogs attacked with it died, and from 60 to 75 per cent. of young hogs attacked died. Various remedies were tried, with but little effect. Before the introduction of cholera hogs were healthy in this county.

KINGMAN.—Hog cholera made its appearance in this county in 1884. I think it was brought to the county by importing a finer breed of hogs; because before that date hog cholera was unknown here. I have been in this county ever since it was first settled in 1876. We formerly made more money out of hogs than anything else. Now we lose more money than we make by trying to raise them. We try everything as preventives and remedies, but without success. Horses are healthy. We have lost some cattle by dry murrain.

LABETTE.—I first heard of hog cholera in this county in 1877, when a number of animals died. Since then it occasionally makes its appearance in parts of the county. I have not heard of the prevalence of the disease during the past year. We know of no certain remedy for it. A few cases of Texas fever occurred among cattle the past summer.

LANE.—There are but few hogs in this county, and no cholera has appeared among them.

LEAVENWORTH.—When I came to this county in 1855, hog cholera was already here. It was imported from Missouri direct, as the Missourians drove whole herds here in settling Kansas. For a number of years, however, no hog cholera has prevailed here to any great extent.

LINCOLN.—The health of hogs in this county, as a general thing, has always been good. A few have died with what some deem the cholera, but I have my doubts about it, as it was most always confined to one farmer or stockman. He never did anything for them. In a herd of 50 or 100 head only a few would die at a time. The greatest loss has been among young pigs from four weeks to three months old, but more for the want of care than anything else. There are but very few hogs in the county now, as there is nothing here to feed them on. A few horses have died of distemper, and a few more were killed because affected with glanders. A number of cattle have died of black-leg.

MCPHERSON.—Hog cholera made its first appearance about six years ago among hogs near the Harvey County line, and was said to have been introduced into the neighborhood by hogs shipped in from Missouri. The loss was but slight until between two and three years ago, when it rapidly swept over the entire county, destroying the greater portion of the hogs then on hand. Since then it has not appeared in such an aggravated form, but still remains in the county, some neighborhoods being entirely exempt while others suffer losses. Heavier losses have occurred this winter, I think, than last. Hogs were very healthy here previous to the first appearance of cholera.

MIAMI.—None of my assistants have reported, but as near as I can learn hog cholera has appeared in localities in the county, off and on, since 1860; some years very bad, and others comparatively none. It acts differently with the same lot of hogs. Some will scour, and others will be right the reverse. Some farmers will lose all their hogs, while another right across the road will lose none. It seems to attack them under all circumstances, the clean and filthy, and the fat and lean. What one thinks is a cure and preventive one time will have no effect the next.

MITCHELL.—Hog cholera has been very prevalent in this county during the year. Its first introduction into the county was probably in the fall of 1885. I do not know how it was introduced. Hogs had always been very healthy previous to that time. The disease is not near so prevalent now as during the fall of 1886.

MORRIS.—Horses are better protected than any other class of stock, and hogs have the least care. Hog cholera was unknown in the county until about six years since, when some of our enterprising citizens bought several loads of light hogs in Illinois and sold them to parties here. About half of these animals died of cholera, and we have had the disease in the county ever since. The best preventives are good, warm, dry, well-bedded sleeping places, with an abundance of coal-ashes and salt. The number of hogs raised in this county the current year is estimated at 10,300. Of these 350 were lost by disease, entailing a loss of \$1,750.

NEMAH.—Previous to 1880 hog cholera did not prevail in this county. About that time it commenced in the yards of the large feeders where cattle were fed on corn by the hundreds, and the hogs were kept in large numbers to follow the cattle and pick up the scattered corn. In cold weather they would bunch up in the night, the under ones becoming warm and the outside ones being almost frozen. Every morning some would be found dead. The fatality spread over the county, and was said to be spread by dogs carrying the dead meat home to eat, and by buying and exchanging hogs. The former symptoms changed many times. Their only feed in winter was corn and ice-water. It spread nearly everywhere in the county; and even in summer, when turned into the clover fields, they did not stop dying. But hogs fed some milk will recover; indeed they will not have the cholera when thus fed, but not many have that. Many remedies have been tried, but still frequently whole herds will die under the best care. Almost all sickness among hogs is usually called cholera; but the cholera has its peculiar features which are unmistakable to those having experience.

NESS.—No cholera exists among the hogs in this county. I have not heard of the prevalence of disease among any class of farm animals.

NEOSHO.—There has been no cholera of any account in this county. Some few cases of pigs dying with swine plague. I could not get the statistics in full in regard to stock as our assessors failed to do their duty in that respect, and did not make report. Many cattle have died by being allowed to run on stalk fields.

NORTON.—Hog cholera was introduced into this county about three years ago, by parties sending to other States and the eastern portion of this State for hogs with which to improve their stock; also by hogs brought from abroad to feed with cattle here. The disease is confined to neighborhoods, and is not general over the county. Hogs were very healthy here before cholera came.

OSAGE.—During the past year domestic animals of all kinds have been generally free from disease. In the year 1886 hog cholera was reported as existing in various portions of the county. In some localities the losses were very heavy. No special cause could then be assigned for its appearance. Some were severely affected that were confined in small lots in close pens, while others that had free range of large pastures with good spring water were also badly affected. No remedy was found. It seems that those "that were to die of cholera died, and those that were not didn't." So the matter remains as much of a mystery as ever.

OSBORNE.—Hog cholera appeared in this county about two years ago and was very destructive for a year or more. Since then it has gradually disappeared, until now but little is heard of it.

OTTAWA.—I do not know when hog cholera first made its appearance among our swine, but I think in the summer of 1884. Our hogs were quite healthy before that time. Nor do I know how it was brought here, but it could easily have been brought in stock cars which come to take our stock to market, and frequently bring cattle and occasionally hogs in to feed. During the year of 1885 it swept off about one-third of our hogs. It was much worse among hogs kept on running streams, where infection, and sometimes dead hogs, would float down from above. No certain remedy appears to have been found. Hogs have generally been kept in large numbers in close, filthy, unprotected yards. During the existence of the disease I have kept about thirty to forty hogs and pigs, but have had no disease among them. We have given them the run of a clover pasture and allowed them coal and refuse soapsuds; then had corn and plenty of pure well-water. We did not ring them.

RAWLINS.—No hog cholera has ever existed in this county that I am aware of. I have lived here eight years.

RENO.—There has been no hog cholera in this county this year. All classes of farm animals have been very healthy. A good many old animals died during the latter part of last winter and early in the spring, when the grass was short.

REPUBLIC.—In 1879 a disease attacked hogs in a limited portion of this county, and was confined to a few herds. It originated in a batch of hogs shipped in from Missouri. After that date no disease appeared until some four years ago, when hog cholera, so-called, raged generally throughout the county. It first attacked the larger herds in different parts of the county, and spread from them to smaller ones. I have noticed that herds of 10 to 20 are usually exempt from the disease. Our large herds contain from 75 to 200 and 250 head. Since the outbreak last mentioned it has attacked our large herds almost yearly, though the last two years it has not been so severe, except in a few instances.

RICE.—Hog cholera first made its appearance in this county in 1882. Previous to that time hogs were quite healthy. It is claimed by some that it can be cured by administering a dose of carbolic acid. Since the time of its first appearance there has been more or less of the disease prevailing every year. It seems to have reached its climax about one year ago.

RILEY.—There is not at the present time any general disease among hogs in this county, and I hear of but very few isolated cases of cholera. The real losses to the county from that disease for the year 1887 will be hardly worth mentioning.

SHERMAN.—There is no hog cholera in this county. All classes of farm animals are healthy and generally remain so where they have proper food and care.

SEDGWICK.—The disease known as hog cholera was introduced into this neighborhood in the summer of 1883, by Mr. Glass buying at the stock-yards at Wichita a lot of hogs shipped in from Missouri, and has been with us ever since. I know several who have lost all their hogs this fall. It is prevailing extensively now. A neighbor told me yesterday he had 3 left out of 45 and they were sick. Another killed 20 to-day and will kill 20 more to-morrow. He kills them as soon as they show any symptoms. The first man's hogs, he says, vomited and purged. The last man's have not any of these symptoms, but so far as examined the lesions are confined to the lungs and spleen and sometimes the liver. Resembles tuberculosis as is pictured in the Government report of 1879-'80. This man's hogs have every care and attention, but he has lost more than 600 head since 1883, in three different attacks, viz., 1883-'86-'87. He has several hundred at this time, but the disease is confined to one lot of hogs, as it has been during each attack. He has tried almost all remedies, with no success.

STAFFORD.—Hog cholera was imported, or brought into this county, by importing two hogs (male and female) to improve the breed. The value of the animals lost by this outbreak was \$600. A few isolated cases at a distance of 8 to 15 miles from the above locality, valued at about \$400, were lost by the disease in 1886. I have heard of but one farmer losing any this season. He put coal-oil in their swill and they stopped dying. Assistants all report stock healthy. Where hogs have fine stone-coal, which is strongly impregnated with sulphur, to go to at pleasure, or

salt, sulphur, and ashes (either wood or coal) mixed, no trouble is experienced. Exclusive diet of corn predisposes the system to disease. Smut kills no cattle, but too much dry stalk and husk without salt and water will.

WALLACE.—There is no general disease prevalent among any class of our farm animals. A few hogs recently died of a disease said to be cholera. A few horses have also died from local causes.

WASHINGTON.—In the last thirty years hog cholera has cleaned me out twice, once in Atchison County some twenty-three years ago, and in 1875 here in this county. I commenced in 1875 to give my hogs all the disinfectants I could think of, such as sulphur, soda, copperas, salt, etc. The disease appears to affect the throat, bowels, and intestines. Any remedy good for worms which infest the intestines sometimes helps when given in the early stages. I look upon the disease as partly catarrhal. Indigestion and impaired intestinal dyspepsia would produce worms of itself. It will produce the same result in the child or adult. The plague is present in a few places this year. It was brought here first from thoroughbred Poland China hogs shipped from Nebraska; but the full-blooded Berkshires died as well; the only ones that survived were cross or half breeds. The Poland China have been inbred until they have no vitality, and my experience is that the Red Duroc is the hardiest of all, and that remedies such as gentian, sulphate of iron, etc., that improves digestion and gets rid of the worms, are the best. More grass and greasy food in summer and less dry corn. (A fat hog is plethoric enough to die of itself.) Texas fever was brought into this county in May, 1887, through cattle shipped from Arkansas and the Indian Territory in July. They were quarantined by the State authorities, and on the line of travel all native cattle during the summer feeding over their trail took sick and died. The quarantine continued from December 1. As many as 30 head of cattle a day would die in one pasture or herd. As health officer of the county I saw that they were buried, and the sheriff with posse attended to the same. They were then covered with lime. Lime, salt, and sulphur was given freely to the cattle as a disinfectant.

WOODSON.—No cholera prevails among the hogs of this county. Twenty hogs, supposed to be suffering with hydrophobia, have been killed. Four or five head of cattle, supposed to be affected with the same disease, have been destroyed.

KENTUCKY.

BALLARD.—It would be impossible for me to state how hog cholera was introduced into this county. Hogs have been remarkably healthy this year; not a case of the disease has been known in the county for nine months. All kinds of farm animals are in fine condition, owing to the mild winter so far.

BATH.—Cholera in hogs first appeared in this county about 1860, and has been here to a greater or less extent ever since. Heavy losses have been sustained from it. Many farmers have quit trying to raise hogs on account of it. Many claim to have remedies, but I doubt the efficacy of any of them.

BELL.—Hog cholera made its first appearance in this county about the year 1860. There was no disease among the hogs up to that time, except quinsy, and it was not fatal. The mode of introduction of cholera into this county is not known.

BOONE.—Hog cholera made its appearance in our county about the year 1855, since which time we have had more or less of it. Sometimes it is very fatal, killing nearly all it attacks. In some sections of our county it has been prevailing for the last two months, proving very fatal, some farmers losing nearly all. At the distillery in Petersburg it has prevailed to a considerable extent. I am unable at this time to give the number that have died. Two of my assistants report no cholera in their neighborhoods, while the other lives in the section where it is prevailing, and reports the loss at 400 head, but mostly young hogs worth about \$2 per head. It is still prevailing there. Various remedies have been tried, but without much success.

BULLITT.—The best information I can gather concerning hog cholera is that it made its first appearance in this county some time in the year 1856. No one can say, positively, the cause of its origin, nor in what manner it was first introduced. Hogs were generally healthy previous to that time. All classes of stock are going into the winter in a good, healthy condition, excepting young horses and colts. Distemper has been prevalent throughout the northern portion of the county. Have heard of no deaths from the disease.

CARTER.—The past season is the first one in three or four years that we have had cholera among our hogs. This year it has been very destructive, some farmers having lost all the hogs they had. As to the cause of the disease we can not tell. We have no remedy, that is, none that is reliable. Other classes of animals are generally healthy.

CASEY.—Hog cholera made its appearance in this county in 1865, and killed a great many hogs that year. As to where it came from, or how it got into the county, is not known. It has been killing a greater or less number of hogs every year since. Previous to 1865 hogs were healthy. Since 1865 the hog crop is a very uncertain one. When we raise them up large enough to kill they die by the score. We have some cholera among our hogs at this time. If a hog takes the disease and gets over it he is of no good afterward.

CLAY.—The disease of hog cholera has prevailed in this county to some extent. It is confined mostly to one section of the county, where the disease has prevailed for some years. No steps have been taken to stamp it out except by the use of domestic remedies. There has been no change of the old original stock. I can not give exact date of its appearance, but from the best information I can get it has been confined to this particular portion of the county for about four years. Most all of the hogs in this section have died from it.

CLINTON.—Hog cholera was introduced into this county from about 1855 to 1860. The latter date is the most definite one given by those who lost hogs by the disease in that year. The hogs had what was called quinsy, which more frequently followed a heavy mast year, and was very fatal. I heard one old farmer say that he had never lost any hogs by cholera and assigned as a reason that he fed his hogs on wood ashes. He was a large hog raiser, and owned a farm and grist-mill. I heard another man make a similar statement.

CUMBERLAND.—Hog cholera has been in our county at times for more than twenty years. It rages in one neighborhood for awhile, then another. Some farmers escape entirely, while others suffer every time it comes around. I know no cause for it, and no preventive or cure. We have suffered heavily this year.

DAVIES.—Hog cholera has been known here about thirty years. Previous to that time hogs were healthy. We then had only scrub stock. The better breeds seem to be of a more tender nature—are more susceptible to disease and require better care. The disease will sometimes kill all the hogs in certain localities, while in others the animals will entirely escape. It is a good plan to burn the carcasses, as the buzzards seem to carry the contagion from one locality to another. Its mode of introduction here is unknown, unless the above statement will account for it. Either charcoal or stove coal, wood ashes, sulphur, salt-peter, etc., if placed where the animals can have access to them, will prove beneficial in preventing the appearance of the disease. Our losses during the current year will exceed \$15,000.

ELLIOTT.—The first appearance of hog cholera in this county was in the year 1860. I can not ascertain the means of its first introduction into this county. Hogs were considered healthy before its appearance here.

ESTILL.—There was some hog cholera in my neighborhood in the spring—about the first of May. There were some cases in other parts of the county about the same time. Before that time hogs seemed to be healthy, and no disease of any kind prevailed among them. Since the 15th of June I do not think there has been any prevalence of the disease in the county. Hogs have been in better condition than usual. I have heard of some hogs being sick, and some of the farmers have lost some, but not with hog cholera. We have lost some sheep by the rot.

FAYETTE.—The year of the first appearance of hog cholera in this county, and the mode of its introduction, can not be definitely stated. Somewhere in the years from 1840 to 1848 the hogs of the writer were severely attacked by it, first commencing in young pigs, then older hogs; sows in pig would bring forth their litters all dead, the sows also dying, the losses all told amounting probably to more than 100. Each fall for several years I had visitations of it; had heard of the disease for several years before it visited me; have had nothing of the kind for many years, attributable to the fact, as I think, that now I keep but few hogs, which have a large range on the farm. This is the case with our farmers generally, and I think we would be entirely clear of the disease but for our distilleries, where large numbers of hogs are kept in a very filthy manner, and the losses are very heavy, in many instances amounting to 50 and more per cent. The hogs at those places are picked up indiscriminately, and are sinks of infection. Farmers are careful not to permit their hogs to come near distilleries, or to water flowing from them. Previous to visitations of cholera hogs here were healthy, and large numbers were raised and sent annually to market; now the surplus is small. I had the strangles among my horse stock the past summer and fall, mostly among young animals; lost two very valuable colts from it. Many others fared worse than I did. This county produces the highest type of horses, and the loss has been heavy. The secondary effects of this disease are more serious than the acute stage—blood poisoning and internal abscesses follow. They are a long time in recovering from its effects, and no animal having it is fit for any service short of three or four months. Some cattle died from bloat the early part of last summer.

FLOYD.—Hog cholera made its appearance in this county about the year 1857, and the fatality was great that year. It has raged with intermission since to the present time, and this past year has been extremely disastrous. From the best information I can get fully 70 per cent. of the hog crop, both great and small, have died of the disease the past year. It is now raging in some localities, but not so virulently and with such disastrous results as it did during July and August. I suppose the disease first came to this county through atmospheric influences. Peach-tree leaves or bark boiled in water and fed in slop is said to alleviate, and in many cases, cure the disease. Coal-oil has also been used beneficially—fed in slop and applied externally on the head and back. I believe this remedy was better before the oil was deprived of its explosive agencies. I believe that the oil refined without any preventives against explosions would be an efficacious remedy. Hogs should not be permitted to run on red clover during cholera times. There is something in red clover that aggravates the disease; what it is I am unable to say. Grasses do not have this effect. This county formerly exported a great many hogs, especially before the war, when Richmond, Va., was the market. But it has fallen off until, instead of being exporters of this product, we are now importers, and this incoming year we will have to buy abroad, if we get a supply for our own consumption. It is safe to say that there is not half enough for home demand. But the deficiency has to some extent, and will yet be, supplied by beef; but with both included there will be a deficiency in this county of at least 25 per cent. The market value of hogs this year is \$5, gross.

FULTON.—The cholera first made its appearance among hogs in this county in 1858; don't know from whence it came or how it originated. Have had but little of it this season. Have had some pink-eye among horses and cattle; no deaths. Many cattle were blinded, generally in one eye.

GALLATIN.—No hog disease of any consequence has prevailed in this county during the past eight years, the date of my residence here. Only once do I remember any cases at all, and that was in 1882. These were few and isolated, and were occasioned by the introduction of new hogs into the county.

GARRARD.—Within my recollection all classes of farm animals have undergone a great change in size, form, and disposition, and the hog, perhaps, by handling and domestication, has undergone a greater change than any other domestic animal. In his wild state he is covered with a thick coat of long bristling hair, lined next to the skin with a short, fine, furry coat of hair which keeps him warm, and affords protection against the sudden cold changes of winter. The demand for the hog product as a meat supply induced farmers to feed their hogs heavily, using the richest food to promote a quick growth, in order to bring them to a marketable condition as early as possible. This course of treatment has brought about a great change in the character and nature of the hog. Instead of finding him clothed with a thick coat of hair, with furry lining next to the skin, we now find him generally with a thin coat of hair and almost destitute of a furry lining. Instead of running in the woods and feeding upon mast and roots, he is now feasted upon clover and blue-grass and slops; instead of being handled in small droves they are thrown together in large herds. These changes have invited disease by weakening the general condition, rendering the animal less liable to stand the sudden changes of winter and more liable to the contraction of disease. I have handled hogs quite extensively. By providing dry, warm shelter, and avoiding the crowding of too many together, I have kept them free from cholera. When hogs are affected with any disease they are more apt to communicate it than other stock, as by lying together any cutaneous or lung disease is at once transmitted. Hog cholera has been known in our county for more than thirty years.

GRAYSON.—The first appearance of hog cholera in this county was observed about the year 1854. Some years its ravages are fearful. It has raged very bad here this past season, and is killing hogs in different parts of the county at the present writing. It has been observed that where farmers attend regularly once or twice a week to giving their hogs wood ashes, mixed with salt, that hogs thus treated are rarely ever attacked. Where hogs are regularly fed with all kinds of slops from the kitchen they are also free from all kinds of disease. Murrain is more prevalent here as a cattle disease than any other.

GRANT.—Hog cholera first made its appearance in this county in 1845. There is no reliable account as to how or from whence it came. Its first serious ravages were in 1853. In 1862 vast damage was done. A very material abatement of the disease has been observable during the last four years. This year I do not think more than 75 or 100 head showed any symptoms of the disease.

HANCOCK.—Nothing definite known concerning the introduction of hog cholera into this county. Though very prevalent last winter and spring, there is comparatively none now, and the county is freer of the disease than for years past. So far

as I have been able to learn there is no known specific. Some use poke-root and arsenic, others lye soap on corn, both of which seem to be beneficial sometimes and of no avail at others. Live-stock, generally, is in better than average condition, and no general complaint of prevalent disease save in two localities, where cattle have died from what some in one neighborhood thought hydrophobia, and in the other my assistant thinks symptoms indicate spinal disease; but on cutting open an animal that he himself lost he found its stomach impacted. Some 20 head, perhaps, in both places were lost.

HARLAN.—Cholera made its first appearance among hogs in this county in the year 1863-'64. It was introduced by hogs brought in from Virginia, and has prevailed every year since the above date. Before its introduction our hogs were healthy. Nothing ever tried here has done any good towards checking the spread of the disease.

HART.—From the best information I can get hog cholera appeared in this county about twenty years ago. I can give no data as to the mode of its introduction. The hogs were healthy previous to that time, so far as now known. The condition of stock was somewhat impaired on account of the great drought of the present year, but is now in good average winter condition, with extremely favorable weather for wintering well.

HENDERSON.—Hog cholera made its first appearance in this county about 1853, and was sudden, without apparent cause, and very fatal. Hogs were mostly healthy before that time. Stock generally is poorly cared for here. The animals are allowed to range the stalk fields during the winter, and are usually without shelter.

HENRY.—No hog cholera has existed in this county during the year 1887 that I have heard of. Our hogs have generally been healthy. In fact, we have had no disease with either horses, cattle, sheep, or hogs that could be called contagious, or that prevailed to any destructive extent. Of course some of our domestic animals have died, but not from any special disease. Hog cholera existed here years ago, and often was very destructive. I do not know when it first made its appearance, but I should think twenty-five or thirty years ago, nor do I know how it was introduced, nor do I believe that it is always imported. I think it is the result (often) of natural causes. I think our people are learning the importance of taking better care of stock, and each year shows an improvement in this regard.

HOPKINS.—Hog cholera has been known in this county for a number of years, but it is only at long intervals that it assumes an epidemic form. There has been more of it during the past eighteen months than for a long while before. Hogs were generally healthy before the introduction of the disease, but the mode of introduction is unknown. Eighty per cent., perhaps, of the hogs affected died. The disease gradually "wears out" without remedial or prophylactic measures.

JEFFERSON.—Hog cholera first occurred in this county in the fall of 1859. How it was introduced I am totally unable to tell, or even give a guess. Previous to that time, according to "the oldest inhabitant," hogs had always been healthy.

LAUREL.—Hog cholera was first noticed in this county in the year 1869. It was then very fatal, killing those in good condition while those in poor condition escaped. It has occurred every three or four years since, and generally following what is called a mast year,—hogs living through the winter principally on mast and in the early spring cholera makes its appearance. This generally lasts through the summer and until the fall feeding commences, and even then requiring shifting to different fields whenever the disease appears among them, and the sorting out of all seemingly diseased animals. We have absolutely no remedy that is even generally successful. For a few years we have been exempt from the disease.

LAWRENCE.—Hog cholera made its appearance in this county about the year 1855, and has prevailed here and throughout the State of Kentucky ever since. In the year 1860 the State legislature passed an act offering a reward of \$1,000 to any person who might discover the true cause of the disease and a remedy that would effect a cure. Since that time the investigation has been very thorough; many theories for its cause have been advanced, but none seem to be more rational in making up a diagnosis than that it is a disease of the liver. But what it is that causes a disorder of that organ is for the future to determine. There have been many cures devised and causes alleged for the disease, but I have heard of none perfect enough to secure the reward of a thousand dollars offered by the State. It is thought that if something was administered to them occasionally during the prevalence of the disease to stimulate the liver to perfect action it would prevent the occurrence of the cholera. It seems that they are not exempt from the epidemic in the pen under the most liberal process of feeding, or in the field among the most profuse growth of vegetation. And it further seems that by the process of evolution that the hog has reached a period of time when a mysterious disease has met him, and now,

instead of the once careless manner of treating him, it requires care and attention to successfully propagate his species—care first and cure next. Previous to the year 1855 hog cholera was unknown in this county, and hogs generally were healthy.

LEE.—Hog cholera made its first appearance in this county in 1856, among hogs that were brought from the interior of Kentucky. It has been here about every other year since—generally of a mast year. The majority of farmers in this county think it is the acorns that cause it. There have been no cases of the disease in the county this year. Hogs and all other stock have been healthy this year. Prior to 1856 hogs in this county were healthy.

LETCHER.—Hog cholera has been very prevalent in this county the past year, more than half the hogs having died from the disease. I can not give the year in which the disease first appeared. We believe it originated here from feeding hogs on still-slops from distilleries.

LINCOLN.—There has been no epidemic of the disease commonly termed hog cholera in this county for some time. In some localities quite a number of swine have been lost, the loss being confined almost entirely to pigs and young hogs. From my observation I think the disease termed hog cholera is more like pneumonia or an affection of the lungs. Forty years ago hog cholera was not heard of, but the hogs died frequently of a disease called quinsy, the old hogs being scarcely ever affected with it. We once lost 100 pigs, from a lot of 105, with quinsy. In the wooded districts, or where hogs have a large range and plenty of leaves to make their beds in, they are much healthier than where kept in inclosures and about farms and stables. The putting of rings in our hogs' noses to protect the grass is good for the grass, but hard on the hogs. I have frequently lost some from cold, freezing weather soon after ringing them, and especially if ringed when young.

MARTIN.—About the year 1850 hog cholera made its appearance in this county, killing hundreds of animals. Its first symptoms were in the throat and head, sometimes in the side in the form of boils, sometimes in the feet, and every foot would be affected, taking some of the feet off at the first joint. We tried every known remedy with but little success. The cause of the disease and its origin we could not discover. Before its appearance hogs were healthy and thrifty.

MARSHALL.—There has been in our county this year distemper among horses. But few have died. Hog cholera made its appearance in this county in 1860. How it was introduced I can not tell, unless by the importation of better breeds. In the year 1860 we had a heavy mast; some attribute the disease to that. My attention has been called to the fact that hogs that are kept from the woods generally escape the disease.

MASON.—Hog cholera was unknown in our county until about thirty years ago. How it was first introduced is unknown. Until that time hogs were healthy. The thumps and sore throat were the only diseases that troubled hogs to my knowledge previous to the advent of cholera. I have never had cholera among my hogs but once. It was a dry year and the water was bad. My hogs have rangy pastures and good, dry places (but not dusty) to sleep in. I feed on corn. I don't keep many now. Cleanliness is necessary to the health of hogs.

MERCER.—My first knowledge of hog cholera was in the year of 1850, when it made its appearance in the pens at the different distilleries on the Ohio River, notably at New Richmond, Ohio. I had never known or heard of it before. At that time all hogs seemed affected alike, all vomiting and purging, but of late years more suffer from constipation than anything else. In my thirty years' experience I have had it among my hogs three times, the past summer being the worst. I have never found anything do them any good after they have taken it and would not give a cent for any remedy that has ever yet been prescribed. I think it probable that strong home-made soap, given in large quantities, might possibly serve as a preventive, but my opinion is that it is now an established disease with hogs, as much so as distemper with horses, pneumonia with cattle, or measles with mankind, and am not sure that it is not well for farmers that it is so, as they are but poor pay to the producer at best. There have been no unusual diseases among our stock except in the case of thoroughbred racing stock. Among these a very fatal disease has prevailed. Various opinions have been expressed regarding it. To me it appeared to be distemper in a most malignant form.

METCALF.—There has been no hog cholera in this county for three years. What produces it I have never been able to tell. There is no disease at present existing among any class of farm animals.

MONTGOMERY.—My observation is that hog cholera always follows an oak mast in this county. The last mast was about ten years ago and hogs died by the thousands. In the county of Carter there was a light mast last fall and hogs to some extent died of cholera. The mast was soon consumed, however, and the cholera abated. There was no cholera in Carter and Elliott Counties until the white-oak

mast began to fall. I think the above hypothesis is worth more extended investigation than I have given it.

MORGAN.—Hog cholera appeared here about 1854. How it got here we know not. Previous to that time these animals never had anything except thumps or sore throat.

OWEN.—We have had no hog cholera in this county for four years past. The losses by ordinary diseases for the year will not exceed, perhaps, \$1,000.

OWSLEY.—What is termed hog cholera is the only fatal disease that farmers have to contend with among animals in this section. As well as can be ascertained the disease appeared here about the year 1855. Up to that time hogs lived here in the mountains, until they were four and five years old, perfectly healthy. Occasionally we would lose a few with quinsy. Of late years the cholera visits us every two or three years, and pretty generally after we have a mast. When it does come it cleans the hogs out pretty nearly clean. Last fall a year ago I lost 60 head out of 65. Some of my neighbors lost all they had. No remedy was found to relieve them. Two years ago the symptoms of this disease were different. The animals usually were purged and vomited. The last time they were constipated and the hair would all slip off before they would die. The flies would blow them while still alive. The best remedy we could find was to put them where they could not get any water. Very few animals die of disease in this section except hogs. Occasionally horses die with bots or colic. Cattle have no disease among them. It appears that every time the cholera visits the hogs here it comes in from a north-east direction and travels southeast. Last fall a year ago we had the cholera among our hogs here; this fall it is in Clay County, southeast of here.

PENDLETON.—I do not remember when hog cholera first made its appearance in my county. Myself and many others are impressed with one fact worthy of record—that the hardy native animals were not, and are not now, so predisposed to certain classes by disease, and that hog cholera did not make its appearance until after the introduction of some of the more delicately constituted breeds of hogs. One of my neighbors, whose experience with hog cholera has been greater than others with whom I have spoken, informs me that a cure is comparatively easy provided all fluids are withheld for a reasonable length of time.

PERRY.—There has been no hog cholera in the county for the last year. The disease only appears about every four or five years. It has been several years since it first came into the county, but it only breaks out every four or five years. I don't know the cause of this. The farmers will raise a large lot of hogs and the cholera will strike among them and kill the most of them, and then it will take from four to five years to raise another lot; then the cholera will come around again and decimate the herd. There has been no destructive disease of any kind among farm animals this year.

PIKE.—Hog cholera was introduced into this county about 1850. No one seems to have found a remedy for it. Where hogs are allowed to run at large and have free access to wild roots and vegetation, and plenty of fresh water, they seem to be healthier and freer from cholera and other diseases than those that are confined. They should have plenty of salt, and care taken to separate the affected ones from the healthy so soon as cholera is discovered among them. Some farmers say they find assafoetida with red pepper good to mix with slop for hogs affected with the disease.

ROBERTSON.—No hog cholera in this county. There has been no prevailing disease among any class of our farm animals the past year.

ROCKCASTLE.—Hog cholera prevails in a few localities in this county. When it makes its appearance in a neighborhood it generally proves very fatal during a period of from three to four weeks, when it disappears. The next we hear of it will be in some remote place in some other part of the county. Feeding hogs on hickory wood ashes is the most popular remedy we have. The first appearance of hog cholera in this county is not exactly remembered, but it was about thirty years ago. Have no means of finding out how it was introduced. Hogs were generally healthy before its appearance.

SHELBY.—Hog cholera made its appearance here in the year 1856, having been brought here in a lot of hogs shipped from the State of Indiana. Previous to that time such disease was entirely unknown to our farmers. While we know it to be contagious, yet it can be avoided to some extent by proper care. One of the principal causes is vermin, at least we never knew a case where the animals were not filled with these pests. Another cause is irregularities in feeding, abundantly for awhile and then dropping off because of scarcity of corn towards spring, at which time it prevails more than at any other season of the year. Again, allowing them to sleep in wet straw. When called up in the morning there will a hot steam arise from their beds as well as from their bodies. All of these things we think will pro-

duce the disease known as hog cholera. We do not hear as much of it as a few years ago, because farmers are guarding against it, and do not keep them in as large droves as formerly, as large lots of any kind of stock do better in small droves. No unusual disease prevails among horses, cattle, or sheep.

SCOTT.—I can not give the date of the first appearance of hog cholera in this county, but would say that it has existed here for twenty-five years or more. Some years it is quite general and very fatal, while in other years it is limited and causes but indifferent losses. But very little of the disease has prevailed this year.

TRIMBLE.—Hog cholera made its appearance in our county twenty-five or thirty years ago, but is only an epidemic at intervals, never prevailing to the extent that it does in other localities. Our county is broken, and as a rule the stock have an abundance of pure water, which appears to be favorable for their health. Where cholera does make its appearance our farmers use copperas in some cases; others recommend the use of wood ashes as a remedy.

TODD.—Hog cholera has not prevailed in this county to any great extent for the past four years.

UNION.—I have been a hog raiser and feeder for thirty years; have fed on an average 150 hogs in a year. The first appearance of what is called cholera, in a mild form, was in the year 1862 or 1863. It gradually spread all over the county to an alarming extent. I have never found a remedy (have tried many). When the fever gets among the hogs it will go through the herd, affecting some more than others. About one-half, on an average, will pull through, but are not very profitable afterwards. Scattering the hogs and changing their bedding places seems to check the disease with me. I never have the cholera among hogs when I have tender grass for them to run to and pure water to drink. There is some little pink-eye among the cattle and distemper among the young horses, but not to an alarming extent.

WARREN.—We have no serious diseases among horses, cattle, or sheep, and hog cholera appears to be dying out. From information and recollection, hog cholera showed itself here about 1854-'55, and for the first few years was most violent and fatal. Pine and coal tar, soap, copperas, ashes, charred corn, and turpentine have all been used as remedies. Turpentine has been found the most efficient as a preventive, given in the feed once a month, say a pint to 25 hogs. No reliable remedy has ever been found for the disease.

WEBSTER.—Hog cholera appeared in this county in 1858, about the same date that red clover was introduced. Some farmers thought that clover caused the disease. Prior to that time hogs were generally healthy. I don't know how the disease was introduced, but it was very fatal, affecting all grades of hogs, regardless of condition. Since then I have noticed that it follows a heavy bitter mast. It will sometimes break out during the period that hogs are feeding upon the mast, and again will not prove fatal until late in the spring, even after the hogs are put upon green clover. Now, I believe that the bitter mast first imparts the germ by acting as a powerful astringent, causing intestinal ulceration, after which the hog becomes wormy and begins to fall off in flesh. It is evident, however, that we are sure to have cholera after a bitter mast.

WOODFORD.—Hog cholera appeared in this county about forty years ago, and has prevailed more or less ever since. I never heard of any epidemic or contagious disease among hogs prior to that time. Occasionally they would die from neglect or exposure, one or more at a time, without affecting the balance of the drove. At that time the hogs raised were a long-nosed, razor-backed breed, which were kept until they were two years old or more before they were fattened. They were generally left to shift for themselves, and it was root or die. They slept in the woods in beds of leaves, sheltered from the wind behind some fallen tree, and subsisted by rooting for acorns or anything else they could find. Since that time better breeds have been introduced, which make more than double the weight in less than half of the time. The manner of raising and treating hogs has also been very much changed. They are now fed grain more or less from pigs up. They generally sleep around old straw-stacks or in dusty stables. Whether this change of treatment makes the hog more tender and liable to disease I am unable to say. The best preventive I know is to have a place for hogs to sleep clear of dust, where they will not get overheated and go out in the sudden cold; give them plenty of wood ashes, coal-dust, and sulphur, and if they get lousy pour over them a little coal-oil.

LOUISIANA.

CARROLL.—I have no remarks to make on hog cholera. No one seems to know when it first appeared here. The hogs die and no notice is taken of them. No preventive remedies used, or care or attention given. Nearly every one owns a hog or two, but no one that I hear of is raising to sell.

CATAHOULA.—Hog cholera first appeared here in 1862. The symptoms were vomiting, purging, and fever. They all died in piles in bed. The *post mortems* showed inflamed bowels, and generally the liver and lungs were found affected. The disease has visited this parish about every three years since. On its first appearance it remained two years. We last had the disease in 1885, when the symptoms were different, there being purging and vomiting; but the hogs had a high fever, and many of them went crazy and wild.

DE SOTO.—My individual opinion is that cholera and disease of that kind can be attributed to poverty for a long time, followed by some natural overfeed. Hogs are allowed to run at large here and "root, pig, or die." A field of peas, corn, or oats becomes available. The change of food and excess of food will produce disease in either man or beast. For two years we have made corn, and hogs are kept in good condition. For two years we have heard of no cholera.

EAST FELICIANA.—Hog cholera has been in this parish more or less to my knowledge for thirty-two years. In 1859 I had a fine lot of hogs that I fed twice a day with corn, and had fine range for them to run in. In the month of April they commenced to die—some very suddenly, others lingered for a week before death. I tried charcoal, red pepper, turpentine, and calomel, but nothing appeared to do any good. Out of 150 head I lost all but 15. Some few recovered, but were not fit to kill for two years after. They lost all their hair, and became scaly and rough. The disease will appear in a neighborhood, and some places will lose nearly all, while the adjoining place will not lose any. Cotton seed kills a good many young hogs in the winter and spring. It affects them something like choking quinsy. The condition of stock is better for the year 1887 than for many years, owing to mild weather. Stock in the South is badly treated as a general thing—no care, and no feed in the winter except what they gather for themselves. Before the hog cholera appeared hogs were very healthy. A great many are raised in the wild woods, without feed or attention.

GRANT.—Cholera has prevailed among hogs in this parish ever since 1860-'62. Many hogs died; among those that remained in the woods but very few died. Hogs have died for several years past, it was supposed from cholera. In the year 1886, and again in the spring of 1887, nearly all the old hogs died around home and in the woods. I think the disease was caused by eating acorns that were spoiled, which produces large quantities of worms, and the worms produce cholera. Hogs that are not infested with worms do not have cholera. Hogs are dying now in this parish, but on examination after death their lungs seem to be diseased, which I think is caused by sleeping under old houses and about gin-houses.

FRANKLIN.—The disease called hog cholera among us first made its appearance in 1863, and carried off fully three-fourths of the hogs in our parish. It came without warning, but how or from whence has remained a mystery. Hogs were affected in various ways; some were attacked similarly to stock which have scours. They generally wasted away and died within eight or ten days. Others were attacked with a cough accompanied with thumps. They also lingered a few days and died. Still others died suddenly and apparently without a struggle. It was remarked that those which were fattest died first, and without showing any previous symptoms of disease. Before that disease came hogs were remarkably healthy, and the whole country was literally alive with them, and as nine-tenths of the country was unoccupied, every farmer could raise hundreds of pigs every year. Since that time the existence of hogs has become very precarious, and it is with difficulty that the most careful can keep enough for home consumption.

LIVINGSTON.—Hog cholera, or a disease called by that name, made its appearance in this parish about five years ago, and has been prevalent in some parts of the parish ever since. It is now raging in the southern part of the parish. It is hard to estimate the percentage lost, but it will reach 75 per cent. I have heard of no remedy for the disease.

MOREHOUSE.—Hog cholera appeared in this parish about 1865. Those dying were fat and in fine order. They were taken with loss of appetite; in some the bowels ran off; others on opening were found with bowels impacted with feces and highly inflamed but dry, as presented by the skin of the human family. They would stand and squeal, turning round and round, finally crawl off a short distance and die. Another time 8 or 10 head would be found dead in the bed, all as if they had died while sleeping. The mortality was fearful for several years up to 1868-'72. In 1873-'75 it again broke out, killing out 90 per cent. of the grown and half-grown hogs. As late as 1879-'81 it was still fearful, 70 per cent. dying. Of late, since 1883, it seems to have almost disappeared. I can not ascribe its giving way to any cause other than those surviving having "had it," did not communicate it, and the germ has died out for lack of pabulum. There are no hogs raised in inclosures, so that the range was free to all and the disease spread at will. No care could be taken of the

sick ones, and they thus all had to take their chance. One noticeable thing is that the buzzards would not touch the carcasses of the cholera hogs, while they would eat the entrails of a hog killed that was healthy. It is not known where the disease came from. It appeared simultaneously all over the parish.

NATCHITOCHES.—The first case of hog cholera I ever saw was in 1867, when nearly every hog in this parish died. In twenty days from its first appearance about 60,000 hogs died. It raged for five years so we could not raise hogs at all. About 1872 it disappeared for two years. Most people had a very good start of porkers when it re-appeared and destroyed 90 per cent. of the whole number, and has regularly returned every second or third year since, although some seasons it works in certain localities, while some other places are nearly exempt from it. Up to the above date I had not known over a dozen hogs to die from any disease.

PLAQUEMINES.—There is no such disease as hog cholera known in this parish. Hogs are raised only in a limited way, and for domestic use only. None are exported to either near or distant markets. Other animals, such as cattle, horses, and mules, are sometimes subject to *charbon* during the late spring and early summer months, but in the majority of cases the disease yields to familiar domestic remedies. As a general rule stock in this parish are very healthy, and I have never known a case of hog cholera or other contagious disease except *charbon* to exist here.

POINTE COUPÉE.—Hog cholera prevails to a slight degree, and has so appeared for many years. It is not confined to any section. No one has traced out its origin, nor has a preventive been discovered. It does not spread far and wide, but confines itself to localities.

RICHLAND.—This being a cotton region, there is but little attention given to the raising of hogs except in the wild woods, there being but few pastures suitable for grazing. Such stock, therefore, it is difficult to care for. As to cholera, it is observable that those best fed and most cared for are usually among those most subject to the disease. The disease is most prevalent in the summer when the earth is dry and hard to root. Salt and ashes are the remedies usually given. The only food given is corn, and that in this cotton country is so scarce that hogs suffer more for the want of it than from the disease. If we can raise them in the woods until they are twelve months old, and then feed just enough to keep them gentle, they are not so subject to cholera or other diseases, until we take them up and change their feed.

ST. TAMMANY.—Hog cholera appeared in this parish about 1870, eighteen years ago. How it came and where from is not known. Previous to 1870 hogs were very healthy; in fact, such a thing as a hog dying of disease was not known. Hog cholera is now raging in the parish. One man has lost 40 head in a single week. Some few cases have been treated with heavy doses of calomel and a few of them saved.

TANGIPAHOA.—The oldest citizens remember hogs dying as they do now seventy years ago. Nothing is known as to the introduction of the disease. No contagious disease prevails among horses, cattle, or sheep.

TENSAS.—Owing to the scarcity of hogs in this parish, hog cholera is at this time unknown. *Charbon* is a very fatal disease among mules and horses, and sometimes attacks cattle. During the past year over 100 head of horses and mules died of the disease. The loss from buffalo gnats will amount to 300 animals.

TERRE BONNE.—No hog cholera has prevailed in this parish the present year. A number of horses have been affected, and a few have died of distemper.

VERMILLION.—It is difficult to get reliable data in regard to this disease. I have seen hogs die in Mississippi with an epidemic fever and no purging. It was called cholera, but was more like typhoid or enteric fever. Hogs no doubt have died here with the same disease, and also with genuine cholera. A neighbor sent his sows to a boar where there had recently been cholera, and shortly after lost all with the same disease. In Coahoma County, Miss., in 1861, I was warned to kill my hogs for fear of cholera, which was within half a mile on two sides of me. I gave clean water, fed on corn, and kept salt and ashes, in equal parts, in the pens, and lost none. I lost many with the above-named fever during Sherman's raid, while living in Kemper County, Miss. All were so much demoralized they could not attend to them. Ashes and salt *ad libitum*, turnips, potatoes, pumpkins, oats, and less corn, with slops and grease, would tell favorably upon the disease. Many animals die of disease, some years brought on, I believe, from bad treatment. The west half is sparsely settled and boasts of free hog range, but they generally raise miserable scrubs. This great range for cattle was almost all taken up recently by land "grabbers" at the nominal sum of 12½ cents per acre.

VERNON.—A large number of hogs died last year with a disease supposed to be cholera. It is not known how it was introduced. A few isolated deaths have occurred this winter, but no epidemic has occurred, and no investigation as to cause. I doubt there being one man in this parish who understands the pathology of cholera or could diagnose a case. Kidney worms are numerous in hogs this winter, and persons are not wanting to attribute the deaths alluded to above to this cause.

WASHINGTON.—We have hog cholera in our parish, and it has been here for about twenty years. As to how it came here I can not say, but I know that hogs were generally healthy before it made its appearance. It has prevailed for the last few years to an alarming extent. There have been several remedies tried, the most popular one being common soda.

WINN.—It is thought that hog cholera was first started here by bringing in fine stock hogs from the North. The disease appeared in 1878. Hogs died very rapidly here in 1885-'86 of cholera. They are dying of the disease in the northeastern portion of our parish now. No contagious disease has prevailed among any other class of stock during the year.

MAINE.

ANDROSCOGGIN.—In regard to hog cholera, I do not know of any prevailing in the county. There are losses of hogs as well as of other animals, but our county does not even raise its own pork, and it is seldom losses occur among the few animals we have. So of horses, cattle, and sheep, but there are no prevailing diseases in the county that I have heard of.

AROOSTOOK.—There never has been a case of hog cholera in this county to my knowledge. No epidemic disease has prevailed among any class of farm animals during the past year.

CUMBERLAND.—So far as I can learn, after diligent inquiry, there are no cases of hog cholera in this county, and have been none during the year.

KENNEBEC.—Hog cholera made its appearance first in this county in the year 1879, when a few scattering cases occurred. Not many deaths have ever occurred from this disease. We think that many of the cases were not really the genuine hog cholera. We think that the first cases were those that took place at the Marine Insane Hospital, from imported Chester swine, bought for breeding purposes. A few cases of epizooty occurred among horses during the past fall, from which but few deaths resulted. The condition of live-stock was never better.

OXFORD.—There is no hog cholera in this county. But few animals have been affected by disease of any kind, and but very few have died. A few cattle have been examined by the State board of commissioners, supposed to be affected with tuberculosis, but were pronounced free from it. None have been killed to my knowledge.

PENOBSCOT.—I have not heard of any cases of hog cholera in this county. If there have been any they have not been reported.

SAGadahoc.—There has been no such disease as hog cholera in this county. There have been a few pigs or small shoats that have died from a disease which may be cholera, although we have never known of that name being given it. The pig's ears turn purple, it loses appetite, grows dumpish, falters, and dies. It appears to be somewhat contagious. This disease is not new this year. It has appeared before.

WALDO.—One correspondent, B. B. Stevens, says, "Hog cholera is a disease I know nothing about." Another, M. S. Stiles, jr., "I have no knowledge of a single case of the disease in this State." From our practice of keeping hogs in inclosures that render them nearly isolated they have always been exempt from contagious diseases. Quite a number of hogs died during the year from a sort of apoplexy or colic, a disease which comes on without any warning and is very fatal. It generally terminates in death within an hour or two.

YORK.—Hog cholera has not been very prevalent the past year. It has been confined to hogs brought from New York and Massachusetts. Have not known of a case of it among hogs that are raised in our own county, and as this is not a pork-raising county the loss has been small in any breed. I don't think there are over 500 hogs brought into this county in a year. Aside from those raised here I don't think there have been over 50 died from all diseases this year. In a county like this if there is a case of hog cholera or cattle disease it is known for miles around.

MARYLAND.

ANNE ARUNDEL.—Hog cholera in an intermittent form has existed in this county for a number of years past, but as to the first year of its appearance I can not state. During its ravages many hogs died from it in the aggregate. Not many are raised by one person—rarely more than 6 or 8 being found on one farm—the majority of farmers not raising any. The past year I have heard of no cholera and no epidemic in other kinds of farm stock. Two herds of cattle of 10 or 12 head each were destroyed for symptoms of pleuro-pneumonia.

BALTIMORE.—My assistants report no hog cholera during the year. I myself have not heard of a single case. In 1865 it prevailed among hogs here. It first commenced to attract attention that year, and in 1886 it was quite prevalent, and in every case broke out first among those running at large or in fields of grass or stubble. As to its origin and introduction into the county I have no knowledge.

DORCHESTER.—I have heard of no cases of hog cholera this year. Several horses have been lost by various diseases, such as pink-eye, yellow water, blind staggers, etc.

FREDERICK.—I don't hear of any hog cholera at present, but in the latter part of summer it swept off a large number of hogs. Other classes of farm animals have remained free from contagious diseases.

GARRETT.—Very few hogs have died in our county during the past year with cholera, say 25 per cent. We knew nothing about hog cholera until about five years ago. It is still confined to a small portion of the central part of the county.

SOMERSET.—The year of the first appearance of the disease known as hog cholera is unknown to your correspondent; but a disease which very closely resembles it is known to have prevailed to some extent in this county over thirty years ago. The disease as then known to your correspondent was not so general or so fatal, except to very young hogs, as it has since become. Of late years it has become so general and so fatal in this part of the State as to diminish the pork product largely below the demand of the population. Somerset County now imports more than half the pork consumed within its limits. A farmer told me a few days ago that he had stopped the ravages of the cholera among his swine by the use of tobacco in the water given them. I do not know what there is in it, but it may be worth trying by persons having the disease in their herds. About 50 horses died in this county during the months of September and October from the effects of a disease apparently of a malarial character.

QUEEN ANNE'S.—It is very hard to come at the number of hogs lost by cholera in this county. There has not been a time in the last three years that some part of our county was not suffering with the disease. I have never known a case of pleuro-pneumonia in our county. With the exception of hogs we have not had an epidemic to prevail for some years among farm animals.

TALBOT.—Hog cholera has prevailed in our county in a mild form for several years, and has generally been attributed to local causes. But last year it culminated in a more fatal type, becoming highly contagious. In seasons of intense heat hogs that have had access to stagnant pools were the first to show symptoms of the disease. Last year I had about 30 head. All were perfectly healthy until August, when a hog or two sickened and died in a neighbor's field, it having a stagnant pond. Very soon all were dead on a line north and south between our two rivers. I had heavy hogs apparently well at night, and in the morning would find them in a state of congestion, blood oozing from eyes, ears, and through the skin. Others would not die suddenly, but would lie around a day or two. All treatment failed. Those that recovered, if any, were of no value. We call this disease a malignant type of typhoid. I used the knife and found the intestines ulcerated and inflamed. Many feared to examine dead hogs lest the poisonous matter might be communicated. Sucking pigs took it from the sow and would all die. This year the disease has been a great deal less prevalent. The season was excessively wet, washing out the pool water. I am inclined to think hog cholera develops when the mercury rises between 90° and 100°, with drought, making putrid all pond or pool water, producing the germ that produces typhoid.

WICOMICO.—To my knowledge, and the opinion seems to prevail here, hog cholera first appeared in this part of the old county of Somerset and Worcester about the year 1864. Wicomico County was created by the constitution of 1867, and since that date we have had several visitations of hog cholera. The most severe was in 1873, when it was estimated that 3,000 hogs died in the county. In 1884 the scourge seemed only to attack fat hogs, those in the sty being the greatest sufferers. About 2,500 was the estimated number that died, being worth about \$12,000. The present year the disease has not been so fatal, yet a number have died in the seventh and ninth districts, also in the second and third. The number was about 200. As before, the fat hogs suffered most. Perhaps they were worth \$1,300. Since 1884 I have not heard of the disease in our section. In 1844, I remember, a great many poor hogs died, but poverty was supposed to be the cause. Horses, when well taken care of, seldom die except of old age; but our people treat them badly. Cattle also are badly cared for; seldom well-sheltered in winter. Sheep, a large majority, take their chances in the woods. Hogs do as well as could be expected under the slipshod way they are treated. Our farmers are a careless set, and a large majority of them should be punished for cruelty to their animals.

WORCESTER.—While hog cholera was not at all general in this county, some districts lost heavily by the disease. One or two sections lost many horses from a disease termed staggers. Not exceeding one-fourth of those attacked recovered.

MASSACHUSETTS.

DUKES.—The hog cholera made its first appearance in our county during the year 1886. There were but few cases that year, all of which were in the town of Edgartown. It proved fatal to all that were affected. None lived over six hours after it was perceived. The cause of the disease is unknown. It could not have been contracted from other hogs, as the farmers raised and kept their own animals, and in some instances where several were kept in one sty one or more would die and the rest would remain perfectly healthy. This season I can not learn of a single case.

HAMPDEN.—Hog cholera has prevailed quite extensively in this county, and a large number of animals have died and many have been killed by order of the cattle commissioners; how many I have no means of ascertaining. The disease has invariably been traced to the Western hogs in the distilleries where the swill is fed for fattening purposes. A mild solution of carbolic acid fed in the swill has been used with success in the treatment of the disease. I should estimate that 500 pigs and hogs have died from the disease, and over 200 more have been affected.

NANTUCKET.—Early in the season of 1887 a small drove of hogs were brought here from Suffolk County, and some of them died soon after, giving rise to the report that hog cholera had reached our county; but as the deaths were confined wholly to that drove and no other deaths reported, the conclusion was that the disease had not made its appearance in Nantucket County. Very few horses, cattle, or hogs are raised in this county. Previous to the importation of scab a good many sheep were raised in the county.

PLYMOUTH.—Twenty-five or thirty years ago there were considerable losses from cholera among hogs in this county, but now people appear to know how to avoid it. There has been no visitation of the disease for some years.

MICHIGAN.

ALCONA.—I have been residing here for sixteen years, and have never known any dangerous disease among hogs. No hog cholera prevails in the county. Three fine Jersey cows died recently, I think of some kind of lung fever. If the veterinarian reports the disease a dangerous one I will inform you.

BAY.—I fail to find that there ever was a real case of hog cholera in this county. Most of the farm animals that have died the past year have died from old age.

BENZIE.—In reply I will say that we have not at present, and I am not aware that we ever had, any hog cholera in this county. Horses, cattle and hogs do well here except at times. Cattle in the winter season seem to be troubled with loss of appetite and run down in condition.

BERRIEN.—Our county was free from hog cholera for ten years, up to 1887. At that time the loss was great, but not so great as this year. I am unable to say how it was before that time. A great many were lost through carelessness, by not having fresh water and clover pasture for them. No contagious disease has prevailed among any other class of animals.

CALHOUN.—There have been farmers in this county who have lost hogs, or rather pigs, of different ages, from a few weeks old to six months. The entire loss, so far as my information extends, will not exceed 150 head. One farmer says: "My pigs were first lame and swollen in their fore shoulders, refused food, and died after a few days." Again, a farmer reports the loss of "three out of his pen, but fed the others with sulphur, ashes, and salt, and had no further loss."

CLARE.—In regard to diseases among animals, I have heard of none, except from one of my correspondents, who writes that in one lot of hogs about 30 had died, but he did not say how many there were in the lot, nor what was the exact nature of the disease. There have been some deaths among animals from various causes, but the mortality has been light during the past year, perhaps ranging from 3 to 5 per cent.

DELTA.—Hog cholera has never appeared in this county. Glanders has prevailed to some extent among horses.

EATON.—Hog cholera first made its appearance in this county in the summer of 1883. About 100 hogs died from the disease. Since that time I have been unable to learn of a single case of cholera among swine in this county.

GENESEE.—No hog cholera has prevailed in this county this year. A few hogs died last year of what was reported to be cholera. That is believed to have been its first appearance. The mode of its introduction, or its cause, is not known. Previously, and indeed generally at that time, swine were healthy in this section.

GLADWIN.—As regards hog cholera, I have never seen or heard of a case of it in

this county, although we lose about 35 per cent. of our hogs every year. But this loss is not occasioned by disease of any kind; it is for want of proper food and care.

HILLSDALE.—I can not give the year of the first appearance of hog cholera in our county. It was several years ago, and I am satisfied that we had hog cholera long before it was known as such. There has never been any general infection with the disease in this county, but here and there an isolated herd has suffered. I have not heard of the prevalence of the disease for two or three years.

JACKSON.—No hog cholera in this county. There has been no prevailing disease of any kind among farm animals. The deaths have only been the average loss from natural causes.

KALAMAZOO.—There are no prevalent diseases in this county of a contagious, epidemic, or virulent character. All classes of farm animals seem in a healthy condition.

KEWEENAW.—No hog cholera has been known in this county for a number of years past.

LAKE.—There is no hog cholera or other infectious diseases among domestic animals in this county that I am aware of, except a mild form of horse distemper. None died from this disease that I know of.

LENAWEE.—I have not heard of a single case of hog cholera in the county. All report hogs as extremely healthy.

LEELANAW.—I have never heard of a single hog dying of cholera in this county. Hogs are healthy.

MANITOU.—No hog cholera in this county; never heard tell of any at least; no disease of any kind among farm animals; they are all in good condition.

MANISTEE.—I think there has never been any hog cholera in this county. No disease has prevailed during the year among any class of animals. Some correspondents report a considerable number of colts lost from congenital weakness; some were not even able to get on their feet. One reports 25 out of 30 lost.

MARQUETTE.—There are few hogs raised in this county, and they are raised by farmers for their own use. The people purchase the imported article in its frozen state and salt it themselves, or buy already salted. They can buy cheaper than they can raise it. There has not been a case of hog cholera in the county as far as I or my assistants can learn.

MASON.—I can not learn of the prevalence of any hog cholera in our county during the past year.

MENOMINEE.—I have not heard of a case of hog cholera in this county.

MONTCALM.—Hog cholera does not and never has prevailed to any alarming extent in this part of the State. No epidemic is prevailing among any class of farm animals. The condition of all stock at the present time is excellent.

OAKLAND.—There never has been any genuine hog cholera in this county. There has been at times diseases of the lungs; the animals would cough and some die. If the animals purged freely they were pretty sure to die. Sometimes they would die without purging, and we would usually find hepatization of the lungs. This ailment has never been general, and I do not know that there is any of it in the county at the present time.

OCEANA.—No hog cholera prevails in this county.

OGEMAW.—As I have lived here but five years, I can not tell when hog cholera first entered the county, nor in what way. As far as I can learn it has never done much damage. The hogs attacked were in good health a day or two before they died.

ONTONAGON.—There is no hog cholera in this county. There were very few hogs raised the past year. We raise no corn in this county, and it would not pay to buy corn to feed hogs. A good many horses died the past year by being overworked in the pineries and on the railroad, but I have not heard of any dying from disease of any kind.

OTSEGO.—Neither cholera nor any other disease has prevailed among hogs in this county the present year. Last year a disease supposed to be cholera prevailed to a limited extent.

PRESQUE ISLE.—The disease known as hog cholera is unknown in this county. All hogs raised here are fed a regular ration of charcoal, and during the summer months they generally roam in the woods, where they find all the requirements for health.

ROSCOMMON.—We have not as yet had the disease known as hog cholera in this county.

ST. CLAIR.—There is no hog cholera in this county.

SAGINAW.—Two years ago a large number of hogs died while fattening, and it was said they died of cholera. There was nothing of the kind previous to this, and nothing of the kind since. A great many young pigs died last spring from birth to six weeks old, for which no reason could be assigned. They seemed to die without being sick.

SCHOOLCRAFT.—We have but very few hogs in our county. It is so far north that it does not pay to raise them, as we would have to import corn to fatten them.

TUSCOLA.—No hog cholera prevails in this county. No disease of an infectious or contagious character prevails among any class of farm animals.

WEXFORD.—There has not been, to the best information I can obtain, a case of hog cholera in this county. I have lived in the county fifteen years, and have never heard of any disease among hogs. It has generally been very healthy for all kinds of stock. There has been no epidemic of any kind that I have ever heard of, except a few cases of glanders among horses.

MINNESOTA.

BIG STONE.—No disease of any kind has prevailed among the farm animals of this county the past year.

BROWN.—Hog cholera has never been known in this county.

CARLTON.—There is no such disease as hog cholera known in this county, or any other disease that affects hogs.

CHIPPEWA.—There was no hog cholera in this county in 1887, or in any previous year.

CHISAGO.—I am happy to state that we have no hog cholera in this county.

CROW WING.—But few hogs are raised in this county, not enough for home consumption. Many farmers do not raise any. Those we have are healthy. Cattle and horses are in good condition for wintering. No disease prevails among these animals.

DODGE.—It is safe to say that the disease known as hog cholera has never got a foothold in this county. The cry has gone forth once or twice in the past ten years that it had, but it has always ended in the death of a few hogs in one place and that was the end of it. Hogs are very healthy. There is usually a great loss in early spring pigs for lack of proper care and protection. There never has been any epidemic among horses, cattle, sheep, or hogs since the first settlement of the county in 1855, to my personal knowledge. Horses died of old age, bad usage, inflammatory diseases, and wire fences. Cattle died from neglect and exposure, and sometimes from too much clover on a wet morning. Dogs kill the sheep and the hogs get smothered in the straw in cold weather.

FILLMORE.—There is no hog cholera in this county, and never has been so far as I can obtain any information. In fact, no disease similar to it has ever prevailed here. Very few farm animals of any class have died of disease in this county the past year.

GOODHUE.—Hog cholera is yet unknown in this county. No true case has yet been reported. Hog production, as an interest, is certainly growing in importance, and great attention is being given to breeds. In general, it may be said that no prevailing or unusual disease has existed in this county among any class of domestic animals during the past year. There is an increasing interest in the various branches of stock-raising, and improvement in care and breeding is quite observable.

GRANT.—There is not a case of hog cholera in this county. All kinds of farm animals are healthy and doing well.

HOUSTON.—Hog cholera first appeared in this county in 1875, and a little of it has been heard of about every alternate year since. It did not create any great alarm until 1881, when it was believed to have been introduced by importing a boar from southern Iowa. Theories as regards its spreading are conflicting. Many believe that it has been spread by dogs feeding upon animals that died with it, thus carrying the disease to their owners' pens. At first the farmers were careless and left the carcasses unburied. It has now virtually disappeared. The only instance of its appearance within the year was where a drove of hogs were kept with a lot of fattening cattle to eat the grain out of the excrements. Clean pens and a liberal range in clover pastures are considered the best preventives. While it prevailed it affected lean and fat hogs alike.

ISANTI.—Our county has not been visited by the dreaded disease of hog cholera and we hope it will not be. I think this fact is owing to sparseness of settlement as much as to care. The hog crop is always small in this county.

JACKSON.—We have never had any hog cholera in this county.

KANABEC.—No hog cholera has prevailed in this county during the year. All classes of farm animals seem to have been measurably free from disease.

KANDIYOHI.—I can not learn that there has been a case of hog cholera in the county the past year.

KITTSON.—In reply to questions relating to hog cholera, I would say that I doubt

very much whether there has ever been a case in this county. About three years ago I lost about 100 hogs rather strangely, and at the time I thought it cholera, but as none of my neighbors ever lost a hog in any similar way I concluded it must have been caused by some local treatment. Never since or before have I heard of any disease in hogs in this county, and to-day all swine are in a very healthy condition. I can state positively that there have been no diseases of any kind prevailing among either horses, cattle, sheep, or hogs in this county the past year.

LE SUEUR.—There is no hog cholera in our county, nor can I hear of any prevailing disease among any class of farm animals.

LINCOLN.—There is no hog cholera in this part of the State. The disease has never been known to prevail here.

MCLEOD.—There are no cases of hog cholera in this county.

MARSHALL.—There is no hog cholera in this county, and I know of none in the Red River Valley. There is so little disease prevalent in the county among farm stock that the losses are hardly worth giving. Most of the deaths occur from exposure.

MARTIN.—There is no hog cholera in this county at present, nor has there been for the past four years. It has never prevailed here to any great extent.

MOWER.—There is no hog cholera in this county and never has been. There was some complaint in the spring about young pigs being born dead. There seemed to be a lack of vigor on the part of some breeding sows that was unusual. The hogs lived and flourished. Not as many hogs were raised in this county this year as usual, on account of low prices last year, and of course the price of pork here is booming.

NOBLES.—We have no hog cholera so far as I can ascertain. In fact, I have never heard of a case in the county. It is to be attributed partly, I think, to the fact that nobody raises hogs here in any large numbers. Not more than 2 miles south of us, where considerably more hogs are raised, I hear of some few cases of supposed cholera. So far as my own observation goes I should say that this disease is caused by keeping the animals in over-large droves, on the same grounds year after year, and feeding corn exclusively. In this locality many farmers feed quite a little hay to their hogs in winter, and they seem to eat it with quite a relish.

NORMAN.—Hog cholera is unknown in this county, and, as far as my information extends, is not known in this section of the country. Four or five horses, said to be affected with glanders, were destroyed during the year.

PIPE STONE.—There has never been a case of hog cholera known in the county to my knowledge. Cattle, sheep, and hogs are healthy. There was one case of glanders in the county this year.

POLK.—I have had no report of any appearance of hog cholera, or any other disease of an epidemic nature, for the last year in this county. There may be a small percentage of loss from causes not generally regarded as of a serious character.

SCOTT.—The disease known as hog cholera has never been known in this county. Stock of all kinds remarkably healthy, none having died except from accidental causes, or natural death.

STEARNS.—Not a single case of hog cholera in the county this year. Last year quite a number of hogs sickened and died from a peculiar disease, which seemed to emanate from slaughter-houses and spread to several farms. It ceased and has not appeared since last spring. There has been no prevailing diseases among horses, cattle, or sheep.

STEELE.—I am glad to be able to say there is no disease reported among hogs of this county. I have been a resident of the county thirty-two years, and never knew of a case of hog cholera here.

TODD.—I have not been able to learn that there was ever a case of hog cholera in this county.

WABASHA.—We have never had any hog cholera in our county. We have had what has been called scarlet fever by some of our veterinarians, and by others diphtheria, which has been very destructive. It has been confined mainly to young hogs from four to six months old. It differs widely from cholera in one particular, in that the animal will live from fifteen to eighteen days after the first symptoms of the disease are manifested.

WADENA.—We have no hog cholera here as yet. Swine raisers mostly breed from too young sows. No epidemic has appeared among any class of farm animals except epizooty among horses. This is the healthiest location for farm animals I have ever known.

WINONA.—Hog cholera has never visited this county in an epidemic form. A few animals have died in different townships of the county during the year, but with the exception of young pigs probably not more than 10 per cent. of the whole number. Cattle are not as fat as usual, owing to short pasturage. Late fall feed, however, has been good.

WRIGHT.—Hog cholera has never made its appearance among our hogs. No destructive disease of any kind has prevailed among any class of farm animals in this county during the current year.

MISSISSIPPI.

AMITE.—Horses are affected occasionally with glanders and hogs with cholera, of which they generally die. Cattle are very healthy. About one-third of those attacked by disease die.

BOLIVAR.—The cuckle burr causes great fatality among hogs, due to the fact that the seed contains two germs, one sprouting the first year and the other the year after. The succulent sprouts are devoured by the hogs and the rough rind adheres to the throat, thus often killing a great many. The unrotted lint on cotton seed also is very destructive. After overflows the pools of rotted fish cause great disease among the hogs, but this is not very serious if they are liberally salted.

CALHOUN.—Hog cholera has prevailed in this county this fall. It has proved fatal in every case that I have heard of. I have seen but one animal that was affected, and it died in about thirty minutes after I saw it. It came by me on the streets of Pittsborough, panting as though it had been running, and crept under a house and was dead in a few minutes. The disease does not prevail over the county generally. It made its first appearance about 1869, when it made a clean sweep of all the hogs in the county. But since that time we have lost but few with the disease. One man has lost eighteen pork hogs this fall, but his is an isolated case.

CHICKASAW.—Hogs in this county were affected a year ago with a disease that was not understood by any one here. The animals became drowsy, were inclined to stand about in warm, sunshiny places, and in about seven days would break out in little pimples or blotches, and within about ten days from the first symptoms would die. The few that recovered shed all their hair, leaving a smooth, hairless surface. No remedies proved effective. Since then hogs have been quite healthy.

CHOCTAW.—For several years past I have been studying the disease known as hog cholera, and have come to the conclusion that no such disease exists. A careful analysis of many after death has revealed the following: The smaller intestines, in nine cases out of ten, have been found to be literally eaten up with worms. Finding this to be the case, I have quit trying to cure cholera, but have doctored them for worms, and I find in every case, after getting the worms away, they thrive and do well. Corn boiled in lye soap and given once or twice a month will clean the worms out and cure what is termed hog cholera.

COAHOMA.—I have lived in this county for twenty years, and the hog cholera was here before I came. We do not have it every year, nor does it often, if ever, prevail in all parts of the county the same year. I have never had it enough to notice until last year, when I lost 90 or 95 per cent. My hogs were in pastures and lots, and were fed on corn most of the time. I have a neighbor who lives some 5 miles back of me, and who has nothing but the virgin forest all around him for miles. His hogs ran in the woods and he lost all he had but two. I know of no cause or remedy for hog cholera. It has been worse the last few years than formerly.

COVINGTON.—We have been comparatively free from hog cholera the past year. The present year, however, has been ushered in with a serious outbreak of the disease. Hogs are now dying rapidly in various parts of the county, and our losses will do doubt be great.

DE SOTO.—Hog cholera has prevailed very little in this county this year, though it is quite fatal whenever it makes its appearance. Mr. Pace, of Olive Branch (one of my assistants), says: "Some years ago a mysterious disease resembling the quinsy or throat disease appeared among hogs, and quite a number died. A great many persons thought they died from eating bitter mast."

HINDS.—The cholera among hogs has prevailed to a certain extent in sections of this county for several years. It is not known how nor when it first appeared, but it is known to have prevailed more or less every year for some years. Some years it is quite fatal, while in other years there is but very little fatality. Several remedies have been used, but none have been found to effect a complete cure. It is believed to be more in the feeding and general good management by some farmers that they succeed so much better than others. However, we know that a great many losses occur by death, but the causes are not so well known.

GREENE.—I have no means of investigating the disease of hogs, but it is thought they die of cholera. Other classes of stock are doing well, and there are no diseases among them.

ISSAQUENA.—There has been no hog cholera in this county. Some disease prevailed among pigs during last spring, usually attacking them at the age of four or six weeks. Older ones were not affected. I presume freedom from disease may be

attributed to the small numbers on each farm (preventing crowding), and plenty of water and range. Only a few horses are raised in this county; those used are generally obtained from the West. Cattle receive little attention. The planters keep cows for milk, and the increase is usually sold at two years of age, hence the small number. It is a rare case to find one dead from disease. The only trouble with sheep is dogs; no disease prevails. Hogs are healthy.

JEFFERSON.—Hog cholera appeared in our county in the summer of 1885, and ravaged the whole county. It disappeared last winter, and since then we have been free of it. Whence it came is not known, but its ravages were fearful. Nearly 85 per cent. of our hogs died of the scourge. Hogs generally were healthy before it made its appearance. But few animals attacked by the cholera ever get well.

JONES.—As to the history of hog cholera, the first I ever saw in my county was in 1867. Since that time it has been visiting the county every two or three years, doing great damage to hogs. However, during the past year hogs have been very healthy, and an abundance of them have been raised. All classes of farm animals have been exceedingly healthy the past year.

LAWRENCE.—One correspondent reports 1878 as the time of the first appearance of hog cholera, though I think it appeared earlier. It has remained in the county since, making its appearance in different places at times, and then spreading sometimes north or south, but generally west. I would say here that whenever hogs are sick the disease is called cholera. Various remedies have been tried, the most successful (and that more as a preventive) is feed boiled in poke-root (*Phytolacca radix*), with a little coal-oil, spirits of turpentine, and soda added after boiling. Another is salt-peter, copperas, pine rosin from the tree, used by dissolving in slops.

LEAKE.—Hogs have been exceptionally healthy for the last year. There has been a disease among them which I consider pneumonia from what I have read concerning its diagnosis. The limbs of the hog become denuded of hair and very red; they also suffer with a cough and dwindle away. These cases have been few, and, as first remarked, aside from this they have been generally healthy.

LEE.—The opinion prevails, among older persons, that hog cholera was introduced in this county from States immediately north of us. A great many hogs, both for breeding and for pork, were driven here from Kentucky and Tennessee. Its first appearance here was about thirty years ago, since which time our losses in hogs has been very large; but I have doubts as to there ever having been a well-developed case of what is known as hog cholera. When we have a heavy bitter mast the summer following we have so-called hog cholera. Our hogs all running at large in a heavily timbered country, they eat of this mast and almost always die. My opinion is that when the farmer is forced to keep his hogs up that then he will give them proper care in the way of food and shelter, when cholera will become a thing that we read of. For twelve months past I have not heard of the loss of a hog. They seem now to be healthy, and as there is an abundance of corn and no mast, I have no fears of disease. I have been here quite a long time, and have never known as little complaint among stock. Horses, cattle, sheep, and hogs are in most excellent condition, and but few have died, and these from old age or other natural causes and accidents.

LINCOLN.—About 20 per cent. of the hogs (mostly pigs) in this county have died with what is called cholera. The majority that have died have had access to cotton seeds, which have a deleterious effect upon them, especially the improved breeds. The lint seems to lodge in their throats. Everything that affects a hog is called cholera.

LOWNDES.—From the best information I can obtain I am of the opinion that hog cholera has only been known in this county for the past six or seven years. Since its introduction it has been very destructive to hogs. Farm animals generally have been very healthy this year. No disease whatever has prevailed, and the only losses that have occurred have been occasioned by starvation and old age.

MARSHALL.—In many portions of this county the cholera has been very destructive to swine. While we do not raise hogs except for our own supply, yet the efforts to increase the quantity does not materially gain favor owing to this dreaded disease, and for which no remedy has been found. As to the advent of cholera here I could not give specific dates, but for twenty-five years I have seen and heard of it in the county. Before the war we often lost large numbers from quinsy and cotton seeds. Some persons have inclined to the opinion that the introduction of improved breeds, such as Chesters, Essex, Berkshires, Graziers, Poland Chinas, Suffolk and Jersey Reds, produced cholera. Some of these kinds may have done so, but one kind—the Essex—which I have reared successfully from 1857 to the present time, has always been free of any disease like cholera. Some six years ago I bought a pair of Jersey Reds from near Salem, N. J. Two years ago I lost heavily, they being mostly mixed Jersey and Essex. The same year the disease was very general

among all breeds and crosses all over the county. I have put myself to some trouble to learn if any particular breed was more exempt than another, and I find that the Essex with its crossings is more exempt than other breeds.

PERRY.—I can give no further information on this subject than has frequently been given from various sources. The disease of hog cholera made its appearance here in 1865-'66. Previous to that time it was unknown, and hogs were comparatively free from disease. It is not known how the disease originated. We raise hogs almost exclusively in the woods (on the range). I believe many die from starvation, which is attributed to cholera by those losing them. The cholera is more common in the spring months when hogs can get but little sustenance, and they get quite poor. A farmer who gives his hogs proper attention—salt, feed, etc.,—does not have them afflicted with the cholera to the extent of those who neglect them. But we have such disease as cholera and it is very fatal. They are affected in the lungs or bowels, and frequently in both, accompanied with cough and high fever. Coal-oil and spirits of turpentine—in teaspoonful dose—with salt and ashes (hickory or oak) will cure in many cases. I lose only one-half when it visits mine. I follow above treatment. When one exhibits symptoms, he should immediately be removed from the well ones. Very few farmers or stock raisers feed their stock during the winter. Disease is quite unusual with cattle, but they become quite poor in flesh about 1st of March, and a large portion that die may be said to have starved to death. Farmers who winter their cattle by providing feed and shelter lose but a small proportion, and they increase quite rapidly. We have mostly the scrub, and to give an idea of their size, a good fat beef cow will weigh only 250 pounds. We have had scarcely any cholera this year, which will account for the loss of so few hogs.

PIKE.—Hog cholera first made its appearance here in 1856, but not until 1862 was it considered as an epidemic. It has prevailed to a greater or less extent ever since. Hogs were always very healthy previous to the appearance of cholera.

RANKIN.—All my assistants report that nothing in the way of disease that could be called an epidemic has occurred among domestic animals in this county for the last year. As to cholera among the hogs, we frequently have what is called cholera, but I am inclined to believe that it is nothing but prostration, occasioned by lice, fleas, and ticks, that get on the hogs in summer in such numbers as to sap their vital energy. We never hear of hog cholera in the winter.

TIPPAH.—Hog cholera is a thoracic complaint, bacterian in its nature, and Asiatic in its origin. By well-supported tradition the disease was unknown until 1856, when sorghum was introduced into this country. Simultaneously hogs were stricken down, and oats and blackberry leaves took the run as remedies. As a preventive, the hogs should be kept to themselves in a pasture and allowed to sleep in brick vaults, to be heated periodically like a baker's oven. The most potent remedy is tobacco, and the next best is soft soap. On two occasions I have humbly presented this view to the Department, but it has never vouchsafed me a recognition. For horses, cattle, and sheep I would impress upon the Department the importance of the use of Jerusalem oak, weeds, sassafras twigs, and the sawdust and planing chips of sassafras logs. I find that in pasturing there is a great dearth of vegetation of a medicinal character instructively sought as remedial agents. The further we remove from the natural channels of nature, diseases multiply in proportion.

TISHOMINGO.—About every three years hog cholera comes from the east and goes westward. It is spread by contact and by drinking water from streams in which the virus is floating. It generally remains about one hundred days, and usually destroys about one-half of the number of animals. Complete isolation prevents the spreading of the disease. Blooded hogs would seem the most susceptible.

WILKINSON.—We had a disease called hog cholera to pass through here two years ago, which cleaned us out. Hogs have been healthy since, as they were before. There has been some pink-eye among horses this year, but I have not heard of any fatality. Some bloody murrain among cattle, as well as "hollow-horn," but hollow-stomach mostly. Dogs have about abolished the sheep business. Can not sell sheep for more than \$1 per head.

WINSTON.—There has been a disease among hogs for many years here, known as hog cholera, though in a limited degree. I have heard of none this year. I have heard of no disease this year among horses, cattle, sheep, or hogs. I know not what year hog cholera first made its appearance in this county. It has prevailed to a limited extent, I would say, some eighteen or twenty years. I know not how it was introduced into the county. I and others have been successful in checking the disease, when it had made its appearance, by feeding the hogs on burnt corn. Others use sulphur, copperas, etc.

MISSOURI.

ADAIR.—The number of farm animals annually raised in this county are about as follows: Horses, 3,700; cattle, 12,500; sheep, 7,000; hogs, 20,000. Number of hogs lost by disease during the year, about 1,000, valued at \$5,000. The first case of hog cholera I have any recollection of in this county was in 1861. The hogs that spread the disease were brought here from Iowa, and were claimed to be a highly improved stock. I have no knowledge of any disease that killed hogs prior to that time, though there might have been such disease in existence. We are not often troubled with swine diseases. Where we are it seldom spreads much, but is confined to a small territory.

ANDREW.—Our hogs are healthy except when the contagious hog cholera comes into the neighborhood. My adjoining neighbors have lost 100 head the past year. I have resided here twenty years and have never suffered from the disease. I keep my hogs more isolated than most farmers. Have never known the disease to arise except as it comes gradually from a distance. I believe it only arises from contagion; dogs and buzzards carry the germs of it. I think it similar to typhoid fever in man. Have made a number of *post mortem* examinations. Sometimes I found the lungs, and at other times the liver, affected. There were no constant lesions.

ATCHISON.—Hog cholera appeared in this county about the year 1870. It was introduced by hogs brought in from the southern part of the State which were affected with the disease. The disease has been spread in various ways since, by diseased hogs coming in contact with well ones, by farmers visiting diseased herds and carrying the contagion in their clothing to non-infected animals, etc. I believe the disease is also carried by crows. The carcass of every diseased hog should be burned as the safest mode of preventing the spread of the disease. Hogs in this county were healthy previous to the introduction of cholera.

AUDRAIN.—The first cases of hog cholera known in this county were in 1852. The disease was introduced from the southwestern part of this State, so testifies one of the oldest settlers in this county. Before that time hogs were generally healthy.

BARRY.—Hog cholera has prevailed in this county to a greater or less extent for twenty years. Hogs were generally healthy before its appearance. For several years it was (like Texas fever in cattle) confined to certain localities, hence in other neighborhoods the animals were healthy. It still operates about the same way—but at times has prevailed over the entire county. Hogs fattened on floored pens have generally escaped, and its further spread among the same lot has been secured by putting them up on floored pens. It has prevailed to a considerable extent for the last four months here.

CAPE GIRARDEAU.—Hogs have died more or less on creeks and low lands, usually after having a good mast for several years previous. But the disease never became general over the county until the fall of 1885, and the spring and summer of 1886. The county lying north of ours was troubled with cholera, and it seemed to cross over into this county, moving south, and traveled very slowly, taking about six months to spread over the county. The result was that but few hogs were left. After this wave passed over hogs became comparatively healthy, and no disease exists among them now. We found no remedy that seemed to be of much value. No disease prevails among horses or cattle.

CALDWELL.—I can not ascertain when hog cholera first appeared in this county. It has been prevalent here during the ten years I have resided in the county, and until within the past two years has proved very destructive, but the past two years the disease has been restrained considerably by the means and remedies used to prevent and cure it. Hogs were healthy in this section before the introduction of cholera. I do not know how the disease was brought here. The losses during the year were 5,000 head, valued at \$20,000. The general condition of live-stock in this county is good now, considering the fact that water was pretty scarce during the summer months. All stock, including hogs, is comparatively healthy at this time.

CASS.—Hog cholera was almost unknown here until about 1870, when the country became settled up and the hogs were shut off the range and improved breeds introduced. We know of no certain remedy.

CHARITON.—This question of hog cholera is one with two sides to it, for when it first made its appearance in this county all agreed it was imported with the fine stock of hogs introduced from other States. This seemed to be the accepted belief by every one in 1857, the year of its first appearance. My neighbor, S. D. Ellington, was so satisfied that that theory was correct that he would not allow any fine stock on his farm. He fenced a woodland pasture with great care to prevent any of the fine stock getting with his hogs, but in a few years the cholera got into his herd and killed almost every hog on his farm. Another case: Drake & Collins bought in southwest Missouri and in Arkansas about 150 head, in a locality where

cholera had never been known. He fed them with cattle, 1 mile south of my place. I looked at these hogs soon after they placed them there, and if I ever saw a worse lot of scrubs I don't remember it. This was in the fall of 1873. They fed them all they would eat, and as they were with their cattle they could get an abundance and had plenty of water and should have fattened nicely, but they did not seem to improve. Along in March, 1874, they commenced dying, and by May they had nearly all died. There was no cholera at the time in the neighborhood, but from this lot of scrubs the cholera broke out and destroyed thousands of hogs until the country for miles around, in all directions, was scourged.

CEDAR.—There is a disease in this county they call hog cholera, but I very much doubt it. It is more of a lung or throat disease. One man in this vicinity has lost 100 head. They died in pens. He had them in with his cattle. I find that nearly all the diseased hogs in the county are among those that follow cattle.

CLAY.—The disease known as hog cholera first made its appearance here some twenty years ago. The mode of its introduction is not known. There seems two kinds of disease—one affects the lungs, the other the bowels. Both are called hog cholera. Hogs were healthy until this disease made its appearance.

CLINTON.—All remedies have been tried on hog cholera that are known to the human race. My experience is that the more salt you can compel a hog to use, both in feed and drink, the better it is for the hog. Last winter my hogs (about 100) were attacked in January. I fed and watered in a dry lot, using water from a well. I used salt freely in the water trough, and ashes and salt in the pen; lost no hogs until March, when they could procure water at branch and pond. If I had shut my hogs in this feed lot and continued the salt remedy I don't think I would have lost any. If, in the future, I am scourged with this disease I shall try, thoroughly, the salt remedy. The health of all domestic animals has been good, save that of hogs, which suffered greatly from cholera last spring and summer, fully one-half of crop perishing. The crop of young hogs in the county is at least 20 per cent. short. All other classes of stock are in fine condition.

DE KALB.—Hog cholera for the last three or four years has been very annoying in this county. But very few farmers have escaped its ravages. I will put the loss at about one-third of the hogs raised, especially the last year.

DADE.—Hog cholera has never been very prevalent in this county. There are entire townships where it has never appeared. I notice that where hogs have an abundance of good water and plenty of range or pasture but few are ever afflicted with cholera.

FRANKLIN.—Hog cholera was unknown in this county until 1868, when it was introduced by the Berkshire hogs brought from the State of Illinois. In this county the Berkshire and Poland China seem the most susceptible to the disease. Previous to the introduction of the above-named malady disease among hogs was unknown. What are left of the scrub stock ("hazel splitters") are comparatively healthy. A correspondent writes: "My earliest recollection of hog cholera in this county was about the years 1869 or 1870. In many cases the animals, fat, lean, or medium, fell dead as instantaneously as if killed by a stroke of lightning. In other cases they would live hours and days, and some would occasionally recover. No remedy was found, nor has any known cause for the disease been ascertained, though many theories have been advanced. I do not think there is a case of the disease in the county at this time, though there is a disease somewhat prevalent among these animals which I think is pneumonia. The loss from this latter disease is less than in former years."

GASCONADE.—There are but a few sections in our county where hogs have been lost by cholera. I find no other reason for this than exposure to inclement weather. I myself have raised hogs for over twenty years and have never lost a single one. They are kept in a good, comfortable stable and have all necessary care.

GENTRY.—The stock of this county has been remarkably healthy during the past year, owing, perhaps, to the total absence of stagnant water and malaria. The hog cholera disappeared about a year ago and I can learn of none in the county. One correspondent reports an epidemic among some of the cattle, and a loss of about 50 head within a radius of a few miles. He states that the disease was black leg.

GRUNDY.—I can give no information about hog cholera that will be of importance. This county has lost but few hogs for the last two years with the disease termed cholera. A disease called cholera caused a few hogs to die in the eastern part of this county in November, but has since disappeared.

HARRISON.—The hogs raised in this county are mostly Poland China of pure breed, Berkshires, Jersey Reds, and a few Chester Whites. Hog cholera first appeared in this county about the year 1866, and has been prevalent in the county from year to year until the present time. I have no knowledge of how it was first introduced. The disease is very fatal; when it attacks a drove usually from 50 to

75, and sometimes 100 per cent. will die. Hogs were generally healthy in this county previous to 1866. There is no known reliable remedy for the disease.

HENRY.—As near as can be ascertained after considerable inquiry, I think the malady known as hog cholera was first known as destructive to any degree in this county from 1870-'72, and was brought from the east of us by importing a better breed of hogs. One correspondent says it came from Illinois, another from near St. Louis. In my own herd it was contracted from Chester Whites from Pennsylvania. Several horses have been attacked by nasal gleet, and a number of young cattle by dry murrain.

HICKORY.—Hog cholera appeared in this county first in 1872. Prior to that time hogs had been healthy. A few years previous to that date some of the improved breeds of hogs had been introduced, and by them this so-called hog cholera was engendered. This is the general opinion as to the introduction of the disease. A similar introduction of the fine herds of poultry introduced the chicken cholera. The old fashioned "razor-back," "hazel-splitter," native stock of hogs were never known to have cholera.

HOWARD.—So much has been written upon the subject of hog cholera that I feel that anything more would be superfluous. But there is a great deal of disease and death among hogs in this county that is called cholera that is not. Now, it is known and proven here that many hogs die from a superabundance of worms in the intestines, also that hogs take disease and die from effects of lice and from disease of the lungs, caused by sleeping in dusty and filthy beds and from inflammation of lungs and bowels, from cough, thumps, etc. More hogs die from the above diseases than from cholera. The old saw that "an ounce of prevention is worth a pound of cure" is worthy to be remembered and followed in this matter, for after they become diseased nine-tenths of them will die, no matter what you may do; in fact, they won't eat, and to drench them is fatal. The best thing known here is to keep off lice by sprinkling them monthly with coal-oil, and giving them lime in their feed in slop, and for change carbolic acid; also keep in the trough salt and ashes, one-half each, where they can eat at leisure. Do this promptly all the year round and I guaranty no disease among your hogs.

IRON.—One of my correspondents says: "In the year 1876 hog cholera first appeared in this end of the county among the improved breeds, taking almost every one of the improved breeds and leaving the old hazel grubbers free. Farmers then fell back on the old stock and have had no cholera since. From the other end (south) hogs have died with lice and staggers, but none have died with cholera. They do not know what cholera is. I have for years studied a good deal on the hog cholera question. I have raised from 20 to 30 hogs a year for the last forty years, and never lost a hog with cholera in all that time. I always keep my hogs in a good pasture, and never let them out on the range for a day. My pasture has a good, cool, clear spring of water in it, with a good trough for my hogs and stock to drink from. I never let it get foul.

LACLEDE.—Before the war there was no such disease known as hog cholera, and not until 1866 was it known here. A man by the name of M. S. Beckwith introduced the "Chester White" hog from Chester County, Pa. This was in 1865, and shortly after, in 1866-'67, there was a good deal of cholera which seemed to be confined to this breed—full-blood and the various mixtures. Since then the Berkshire, Poland China, and Jersey Red have been introduced. The cholera, however, seems to be confined principally to the Chester White and Poland stock. Our full native stock is not affected at all, or at least I have not been able to learn of an instance. Our hogs were healthy before we began to breed up, but were of a very poor grade. I think the best hog for this county is the Jersey or Berkshire, with about one-fourth native stock.

LAWRENCE.—But one of my assistants reports any disease among hogs, and does not attempt to estimate the number affected. I know of no disease among hogs myself. Farm animals generally seem to be in excellent health.

LIVINGSTON.—The farm animals of our county are exempt from disease, except hogs, of which animals we generally lose about 1 per cent. by cholera. The practice of our farmers is to feed more mill-stuff and less corn. This we think has something to do in keeping our hogs healthy. In years past we lost almost 50 per cent. by hog cholera. The most destructive season was in 1876; since then the disease has been steadily diminishing. More care and a greater variety of food is what has brought about this desirable change.

JEFFERSON.—Hogs are afflicted with a disease accompanied with fever, which seems to be different from cholera. The increase of hogs this year has not been in proportion to the decrease by disease.

JOHNSON.—Hog cholera, in virulent and universal destructiveness, swept over the county in 1876. It had appeared in some localities previous to the above date. Like

any pestilence, it floats in the air, is carried by streams of water, and is also spread by animals roaming around as they used to do before we had a stock law. We have heard of no complaint with regard to the healthfulness of hogs that antedates 1874 or 1875 in this county.

MACON.—There has been no epidemic disease in our county during the past year, and very few losses by diseases. All kinds of stock started into winter in reasonable good condition. Hog cholera made its appearance in our county about 1860, as near as I can find out; some say a little earlier, others say a few years later. How it was introduced in the county I can not tell. Hogs were healthy before cholera made its appearance. It is the opinion of some who seem to know that hog and chicken cholera follow a warm, wet, foggy, muddy winter. My observation is that hogs that are kept up in pastures and well cared for are not liable to have the cholera.

MARIES.—Hog cholera has raged in this county at various times since 1864. It has somewhat abated in its severity in late years. Nearly half of those afflicted get well, whereas it used to kill all or nearly all that took it. One year ago in this locality the cholera followed the water-courses, killing or afflicting nearly all of the swine, while on the upland farms there were but few losses.

MCDONALD.—Hogs have been more or less subject to cholera in southwestern Missouri for many years, though the disease has not been so severe in other localities. Farmers use to a good advantage pulverized sulphur and coal-oil mixed in the swill. They eat it readily. They also pour a little coal-oil along on their backs. They use it about twice a week. They do this when the hogs are well and it keeps off the disease to some extent. One farmer told me he used 30 pounds of sulphur last year on cattle, horses, and hogs. Hog cholera prevailed only in certain localities in the past year.

MILLER.—Hog cholera has existed in this county for twenty years past. The disease prevails here at the present writing.

MONROE.—I do not remember when hog cholera first made its appearance in this county. It played havoc with the hog crops of 1885-'86, many farmers not having enough left for their meat. Our county has been comparatively free from the disease during the last twelve months; but pork at 4 cents per pound and corn at 40 cents per bushel amounts to a very little in the end. Any disease that kills the hogs is called cholera. It does not matter what the symptoms may be, if the hogs die it is called cholera. All cures or sure remedies have failed, and there is not a stockman in the county who is not afraid to handle hogs extensively on account of this dread disease. "Were they healthy before cholera was known?" Yes. Some attribute the disease to ringing and high breeding.

MONTGOMERY.—Hog cholera has not prevailed here this year. It appeared here in 1862. In that year there was stationed along the railroad a regiment of Ohio troops. The infected pork used by this regiment caused the cholera to spread from every camp. Since then it comes around every two or three years. Before that time hogs were perfectly healthy.

MONTEAU.—Hog cholera first appeared in a virulent form in this county ten years ago, and the loss in the year 1877 and for several succeeding years was very large and generally distributed. Before 1877 there were occasional reports of cholera being destructive to hogs in a few localities. Where it came from no one can tell, and the causes are just as mysterious. I think up to fifteen years ago we had no account of any malady among the hogs which caused great loss; hogs were universally healthy if well treated and managed. No effective remedy or preventive has been used here. Our farmers try to get a plentiful supply of pure water, scatter ashes on the feeding places, and administer copperas either in the water or feed, and it is believed hogs thus cared for are less liable to take the disease. There is a less amount of disease than common this year. Horses, cattle, and sheep have been so universally healthy during the year that the loss from disease is not worth noting.

NEWTON.—Hog cholera, as far as I can trace it, came into this county in the form of an epidemic some time during 1875, and seems to have been imported from Illinois. Its ravages were especially great in 1878, when thousands of hogs died of it. Hogs generally are healthy, unless cholera is brought in from some other place.

NODAWAY.—Hog cholera first appeared in this county in 1868. Some years we have lost as high as \$40,000 worth of hogs by it. This year the loss is very close to 6,000 head, mostly young hogs. We have lost six horses from glanders, brought by animals from Illinois. Distemper has prevailed as an epidemic. Probably one-fourth of our horses have been affected, although but few deaths have occurred. Our sheep have run down from 31,000 in 1880 to 7,000 in 1887.

OSAGE.—Hog cholera appeared in this county in 1866. We have had it to some

extent every year since. Hogs previous to that year were healthy. Hogs that run at large are the first to be affected. It appears to be propagated by contagion, as hogs kept in inclosures do not have it.

OZARK.—Hog cholera was unknown in this county until ten years ago. No remedy has ever been found for the disease.

PEMISCOT.—This is an off year for hog cholera. Our hogs are reported healthy from all parts of the county. Cholera generally strikes our county about once in three years. It is the prevailing opinion among our farmers that worms produce the disease we call hog cholera. I believe if farmers would physic their hogs in the fall and spring of the year it would prevent in a great measure the disease that kills so many. Give heavy doses of calomel, then spirits of turpentine in slop, and if the hogs are affected with worms it will clean them out. If not affected the medicine will do the animals no damage. The following preventive of cholera is used by many with success, viz.: One tablespoonful each of black antimony, sulphur, and sulphate of iron, mixed with a handful of slaked lime. This is a dose for twelve hogs, given in slop in the fall and spring of the year. It will not cure the animal after the disease is fastened on him, but is a preventive.

PERRY.—My experience with hog cholera is that it comes and goes periodically. At this time there is cholera in some localities, but it is not so general as it has been, as but few hogs comparatively have been lost in this part of the county. It seems to be more fatal in the bottom lands, along water-courses, and especially in Bois Brule bottom, along the Mississippi River. Other stock seems to be doing remarkably well, considering the protracted drought in the fall. Our pastures were played out when the rain came, and our stock was rather thin to commence the winter, but so far seem to be doing very well. Some distemper prevails among young horses, but the disease does not appear to be very fatal.

PLATTE.—We have had no contagious diseases among horses, cattle, or sheep. About 30 per cent. of the hogs have been infected with what we call hog cholera, of which nineteen-twentieths have died. The first appearance of the disease was in 1861. Up to that time hogs were remarkably healthy. Every disease the hogs have is called cholera here. Sometimes it is diarrhea; at other times the animals are constipated, and always lousy. I think a small microbe throughout the entire hog is the cause of the disease, call it by whatever name you may.

PUTNAM.—The so-called hog cholera appeared here some twelve or fifteen years ago. Previous to that time hogs were comparatively healthy. In some respects the disease seems to be quite mysterious. The symptoms are not always uniform. While some have diarrhea others are constipated. Some die within a few hours or days; others linger for weeks and then die, while a small portion recover. Its mode of introduction is also mysterious. No remedy has as yet been discovered. Some have tried salt, charcoal, sulphur, and various other things, but all to no purpose. For the last year or two it has not been so bad as for some years previous.

RANDOLPH.—There has been less hog cholera in this county during the last year than usual, supposed to be from the fact that swine are not now allowed to run at large. No cure for the disease has yet become known here.

SALINE.—According to the best of my recollection, the first cases of hog cholera made their appearance in our county about thirty years ago. Then it was in certain localities, but in a short time spread rapidly over our county, and soon became general. On an average this loss per annum has been about 22 per cent. for the last twenty years. Cholera can be propagated in many ways—by contact in herds, by the excrements, by the matter of dead hogs being carried from one section to another by dogs, birds of prey, etc., even by saliva, through fences, by passing droves along the road. Some lots of hogs were brought into my section from Kansas last summer, and the loss was about 75 to 90 per cent. Native hogs have been comparatively free from cholera since last spring. During the drought this fall in Kansas a great many hogs were brought from there into this county, and nearly all died of the cholera. Some Texas fever in certain localities, caused by several lots of Texas cattle that were brought into this county last summer. Horses comparatively healthy, except distemper among young colts.

ST. CHARLES.—Hog cholera has been prevalent in this county for twenty years or more. The disease varies greatly in different localities, and symptoms are widely different. Sometimes the animals have diarrhea; sometimes they are costive; again they may have thumps, and again what is pronounced lung fever. In most cases it has a quick fatality. When they have the fever they generally linger several weeks, and at least one-third of this class recover. As far as my information goes, there has never been a scientific or careful examination made as to the cause and character of the disease as it prevails in this county.

ST. CLAIR.—Hog cholera has been known here for about ten years. We had very little disease among hogs previous to that time. A few hogs died of the mange,

and a few of kidney worms. Except in this way we lost no hogs worth mentioning. The cholera is not now so fatal as in former years.

STONE.—Hog cholera was not known here until about the year 1867. It is thought that the importation of Berkshire, Poland China, and some other breeds into this county about the year 1867 was the cause of cholera. The native hogs had no cholera up to that time, and for some years afterwards. They were remarkably healthy, never having had any disease but blind staggers.

SULLIVAN.—There is no hog cholera in this county at present. The first of the disease in this section was in 1860. But very few hogs in the county in the early years of its appearance, and they were among the improved breeds. Hogs were entirely healthy previous to the appearance of cholera, and there never has been any other disease among our hogs worth naming. Our best hog men attribute cholera to too much crowding, too much in-breeding, too much corn, and too much fat. In fact some parties say that grass and clover hogs will not have it. My opinion is that we must retrace our steps in the hog-breeding business or be constantly subject to disease. Our hogs are all unhealthy, even before they are born. Have never had any success doctoring. The Jerseys are healthier for me, I think, because nearer the natural hog. Am raising hogs with a good cross of scrub, and do not feed on corn exclusively until time to fatten. Cholera assumes all forms, and is no cholera at all, and I don't know anything about it. All other stock healthy, except distemper among colts. Nothing fatal.

TEXAS.—Hogs have various diseases here, but they are all dubbed cholera. Lung troubles are common among them, and a year ago everybody's hogs had something they called the measles. Many died. My father says he does not think the real hog cholera has ever been among the hogs in this county—that every disease is called cholera that hogs are heir to.

WASHINGTON.—Considerable mortality has occurred among cattle and hogs in this county. The death rate among cattle is on the increase. The diseases seem to baffle the skill of the best farmers. Diseases of a fatal character among hogs also seem to be on the increase.

WEBSTER.—Hog cholera first appeared in this county fifteen years ago, and there has been more or less of it every year since. It seems to attack one section of the county at a time, and where prevalent it does not subside until 75 per cent., or perhaps all the hogs, die. Various remedies have been tried, but all have failed. No other class of animals is subject to disease. You seldom hear of cattle, horses, sheep, or mules being sick. The loss of hogs in the county for the current year will aggregate \$2,000. As a rule the large hogs are the ones that die.

WORTH.—The first appearance of hog cholera here was in the year 1866. It was supposed to have been brought in by hogs shipped here from Illinois and elsewhere. Hogs were generally healthy previous to that time. There have been no losses of hogs by cholera this year.

WRIGHT.—Hog cholera first made its appearance in this county about 1868. The general supposition is that infected hogs were shipped into this county for the purpose of improving the stock, and brought disease with them. Prior to that time hogs were healthy. It is believed by some that the disease can be prevented by using fermented food. Our climate for cattle, sheep, and horses is very healthy, and most of the diseases that are found among them are brought on by maltreatment. I am convinced that all our losses on hogs are not caused by cholera. Other diseases feed upon our hog crop.

MONTANA TERRITORY.

DAWSON.—No appearance of hog cholera in this county. Not many hogs are raised here.

DEER LODGE.—Hogs are raised in this county only on a very limited scale, and none have died from disease. The season being too short for the production of corn, hog-raising is not profitable.

JEFFERSON.—The only known disease among horses in this county during the past year has been glanders, and it is estimated that about seventy-five head have been killed by order of the veterinary surgeon, aside from those that died from the disease. It is thought it is now entirely eradicated. It was never known to exist here before. In other counties it has prevailed to quite an alarming extent. Cattle have been remarkably free from disease in the county the past year, but the losses since last January have been heavy, mostly caused by the fearful storms and cold of last winter. Many that did not actually freeze to death afterwards died from the sufferings endured. In this county it is estimated that 20 per cent. of the whole number died. Other counties lost nearly 50 per cent., and it is estimated that the total loss in the Territory is 40 per cent., at the least calculation. Loss of sheep from same cause is 23 per cent. No disease among hogs.

MISSOULA.—No such thing as hog cholera has ever been known in this county. No epidemic disease of any kind prevails among farm animals.

SILVER BOW.—We have no such disease as hog cholera in this county. A number of horses have been afflicted with glanders.

NEBRASKA.

BOONE.—Cholera was brought into this county by the importation of hogs from diseased districts. Two years ago we lost heavily by the disease, but last year our losses were very light. This year the losses have been very heavy again, and the disease so wide-spread that farmers have sold off closer than ever. Mr. Stevens lost 60 hogs out of 65; Mr. Clark, 60 out of a herd of 80; Mr. Rengler, 30 out of 50; Mr. King, 150 out of 400. This is a fair sample of the average losses among our farmers. This cholera resembles very much scarlet fever among human beings. We find no preventive, much less a remedy for the malady. We generally burn the carcasses. Those raising thoroughbred and pedigreed hogs have no better success than those who have the more common stock. With the exception of a few cases of glanders, horses have been healthy. Formerly we had 20,000 head of sheep in the county; now only about 100. This has been brought about by being too far from market, no domestic grasses, and the decrease in the price of wool.

BUFFALO.—Hog cholera has lately made its appearance here. It is thought to be worse and more fatal than last year. The animals are being shipped off very rapidly, as corn is a short crop, and is worth 40 cents per bushel. Much of the crop is being hauled to Kansas, where they have no corn.

BUTLER.—Hog cholera raged with fearful mortality in portions of this county during the summer and fall. Its first appearance this season was in July, at least in the district that has suffered the most severely, and on a farm where some 500 or 600 hogs were kept. This farm has been devoted principally to hog-raising for a number of years, and this is the first outbreak. The loss is estimated at \$3,000. Closely following this, on a farm a mile distant, it broke out, and a loss of 200 hogs is reported. I should add that on an adjoining farm there was great fatality among the pigs in early spring, but it was not attributed to cholera. I am not prepared to say that it was not the cause, however, in either case. No one can venture an opinion as to the cause, or where the disease came from. From this the disease spread over the entire township, and into adjacent townships. In this township there is an average of four farms on every section; but two farmers escaped an outbreak with a destruction of \$100 to \$3,000 worth of hogs to each farmer. In the aggregate this township has lost more than \$40,000 from the hog cholera this season. Your correspondent was fortunate in losing but 150 head. We are glad to report that while there has been more or less over the entire county, this section has suffered most. At this writing it has apparently run its course. Four years ago there was an outbreak, the first I have knowledge of. It was very severe. This year the older hogs are the ones that have more generally escaped, while four years ago the rule was the reverse. It is not known where the disease originated. There has been comparatively no loss of horses, cattle, and sheep from disease here. I can not speak more definitely at this time.

BURT.—Hog cholera first made its appearance in this county about the 15th of September, 1877, and has been more or less disastrous ever since. It was more fatal in 1884, when it took about 80 per cent. of all the hogs in the county. Since that time it seems to have lost its former destructiveness; that is, it does not seem to make so general a sweep as formerly, nor is it so liable to kill whole herds as of old. Sometimes only a few will die, instead of all; but it seems to be almost as fatal as ever. When a hog takes it it is almost sure to die. It seems to have started by diseased hogs shipped in from other places, where the malady was raging. It appears to follow railroads and spread therefrom. There seems to be no cure whatever. The only hope is in preventing it by sanitary means, and in dieting our hogs.

CASS.—Hogs have died ever since I came to the county (say twenty years) every few years of cholera or swine plague. I consider them the same disease, or near so. There is no sure cure for it, and when a herd gets it they nearly all die, and the few that do not die are of little account afterwards. As to means or mode of introduction, I only know this, that where hogs are kept after cattle all winter and spring in small feed pens, and an immense amount of litter left on the ground so that the ground is thoroughly saturated with dung and urine of both cattle and hogs, and then when hot weather sets in so that the whole mass of litter ferments and generates poisonous gases, this condition will breed cholera, and when engendered under such conditions is as fatal as that disease. We do not know when or how it came; in other words, it comes from bad keeping (in dirt), and from too much fat-making

feed. What is wanted is more cleanliness and more muscle-making feed, especially while the hog is growing.

CHASE.—Hog cholera has not made its appearance in our county as yet.

CHERRY.—No cases of hog cholera have as yet appeared in this county.

CLAY.—Cholera made its appearance among the hogs of this county in the early fall of 1884, with very fatal results. At least three-fourths of the entire hog crop died from its effects during the fall, winter, and spring following. There have been frequent outbreaks since, with much smaller losses. I know of no well-directed effort to treat the disease. There is but little attention paid to sanitary measures. The heaviest losses have occurred in those herds kept in close, dry yards, with little or no green food.

COLFAX.—Hog cholera was running riot here a few years ago, but this year so far no cholera has been reported.

CUMING.—The year of the first appearance of hog cholera in this county was in 1885. These animals were healthy previous to that time. The disease did not prevail during 1887.

DAWSON.—The so-called hog cholera first made its appearance in this county about three years ago. There can be no mode of introduction given correctly. At first it was supposed to have been introduced by infected hogs which were thrown in the streams. Those living along streams generally constructed their hog yards so the hogs could have access to the water, thinking the hogs would enjoy better health. At first the disease seemed to follow the stream; now it makes no difference whatever. It will break out in a new herd miles back from the streams, several miles from any infected hogs, but where it gets a foothold most of the herds in the vicinity seem to take it, although some escape.

DIXON.—There is a disease among the hogs of this county that has prevailed more or less since 1882. The loss has been very severe. I had it among my hogs the winter of 1883, and again this winter, and perhaps can give no better description of it than to explain the way it operated on my herd, which, as near as I can ascertain, is about the same in all cases. In the first case it is more fatal with shouts and pigs than older hogs, although in some cases the older ones die with it. The pigs that were born in the spring of 1887 looked very thrifty, except one or two which were removed about August. They began coughing, say one or two of them. This cough seemed like an effort to throw off something from the lungs, or as if dust were in the throat. In some cases they refused to eat and grew thin, and finally would die. In other cases they would seem droopy and dull, and would die very suddenly instead of lingering as in the case of gradually growing poor. They all seemed to be thirsty, and would drink at every opportunity. I changed feed from corn to ship-stuff. The bowels in some cases would be very loose and the secretion would be like black water; in other cases the manure would resemble that of sheep, being very hard and black. Some fat hogs would get sick and refuse to eat for a week, but would come around again all O. K. When they died there was a very disagreeable odor. I fed some of the advertised remedies, but with no success. Had several cases where there would a sore come on the leg or back. Have one hog now in the yard which has recovered and there is a large swelling coming on the back directly over the shoulders. It will break after awhile. It does not seem to affect the hog. My hogs are bred from an English Beekshire boar crossed on good common sows, in which there is considerable Poland China. I had a pure-bred sow two years old, but she did not seem to be affected. I have lost 20 last spring pigs out of 30. In one case I had 2 pigs bred as above stated that came in March, 1887; one got the disease and is just alive at this writing; can not say whether it will pull through or not; the other is and always has been through the whole time as thrifty a hog as I ever saw (both are sows); never seemed to have it at all. I have known cases where it did not affect a neighbor where the farms join. My yard is away from running water; I get my water from a well. As in all such cases, all local parties have remedies, but I think I can safely say that none of them are any good. I think the trouble is with the lungs. I have known cases where the disease had entirely disappeared from a section of the county and suddenly would break out in a herd that had been healthy when it was in this section before. The diet is almost wholly corn in this county. Have seen cases where all the hair came off. I had several hogs where the black hair was mixed with white, making the hog have a gray appearance after the disease, which prior to it was coal black.

DODGE.—My assistants have made no response to this circular, and I can only give you what I know in my own vicinity. Hog cholera, or whatever it is, has visited three farms and destroyed 75 head on one; 70 head on another, and 120 head on the other. The disease has not been as general as it was a few years ago. One of the men introduced the disease by buying a load of hogs that proved to be sick, but in the other cases there was no visible cause.

DOUGLAS.—In regard to hog cholera, there are a good many hogs dying around here, but they are mostly small shoats; but they linger for days before they die. The disease, I think, should be termed hog disease and not cholera. It is a lung disease, as they are first noticed with what we farmers call the thumps. I have lost several the past week from three to five weeks old. My larger ones are all right. One of my neighbors, about 2 miles north of me, is losing his pigs weighing from 30 to 50 pounds each. He lost all his large hogs three years ago, and he called the disease cholera. Mr. Corliss, two or three years ago, shipped from South Omaha to his ranch at Waterloo 250 head of large-sized shoats. Last Thursday he told me he had lost 50 head; they were still dying, and he is liable to lose the whole lot. Now, I have taken notice several times that hogs shipped here from other parts are the first to die. Two brothers, living near me, shipped in here from Iowa two car-loads of nice shoats three years ago, and they all died, but not before they had eaten an immense quantity of corn. If we can not save what we raise here there is no use shipping them here from other parts. I think it a good idea to cross the breed of hogs often. I am doing it, and many of my neighbors are doing the same. Some say keep them clean, but that don't always count, for a neighbor of mine, living only one-half mile east of me, when we were all losing our hogs three years ago he did not lose one, and his hog pen was one quagmire. When he would feed them corn it would go out of sight in the mud, and the hogs would have to fish it out the best they could, yet he never lost a hog, while they were dying for miles all around him. I had a hundred-acre lot, hog tight, with plenty of clear spring water, and tame grass, plenty of acorns and nuts, and yet my hogs died. They also had plenty of clay or marl, which they will eat by mouthfuls, and yet they died; so I say who can account for their dying? I have given up a long time ago trying to guess, but I think it is all owing to the season. Last fall I built a pig-gery to raise fall and winter pigs, and I raised some 80 head until this last week, when some of the little ones commenced to die with what I call the thumps. Now I think I have tumbled to the cause of having the thumps. They can get no sunshine penned up under the roof. Sunshine is needful for everything. I built this place to save the little pigs from the wolves, which are very destructive to pigs. At the present price of pork it don't take many hogs to pay for a good building, and you know we poor farmers have to keep doing something to make both ends meet.

DUNDY.—I have made considerable inquiry about hog cholera, and have not heard of a single case, so far, in the county.

FRANKLIN.—Hogs are unusually healthy this season; some droves are troubled with cough which is attributed to dust by some, while others say it is caused by worms. However, but few losses are reported. The so-called hog cholera has had a foothold several times. It is usually brought in from a distance. It first appeared in this county about 1880, I think.

FRONTIER.—There are no cases of hog cholera known of in our county.

GREELEY.—There has been a great deal of sickness among pigs under six months old. It is not cholera, but a lung trouble. The pigs are taken with coughing and running at the eyes. They at once commence to pine away, and generally die in from one to six weeks. I should think that from 45 to 50 per cent. of all the pigs born in this county die of the disease before they reach six months of age. There has been some cholera among older hogs, but the losses have not been very great. Six horses affected with glanders have been destroyed this year, and three others are now quarantined by order of the State authorities.

HALL.—No cholera has occurred among hogs in this county during the current year. The increase in the various classes of farm animals for the year may be given as 10 per cent. in horses, 30 per cent. in cattle, and 17 per cent. in hogs. There has been a decrease of 40 per cent. in the number of sheep.

HARLAN.—The first appearance of hog cholera in this county was in 1885. The health of hogs has always been good here. The cholera was brought to this county from Illinois in a car-load of breeding hogs which were sold to farmers all over the county and thus scattered the disease. Very little disease among any class of animals at this time.

HAMILTON.—As a rule, hogs were healthy and did well before the disease of cholera appeared. Can not say that any locality is exempt. Lye, a teaspoonful to a pail of slop, is said to prevent and also cure the disease. Powdered lye is also used. Have had no experience with it, but have heard from those who have. Can not tell the years in which it first appeared, or how it was brought into the county. About 20 per cent. of the hogs die annually of the disease.

HAYES.—We have no hog cholera in this county.

HITCHCOCK.—Hog cholera was not known in this county until within the past year. Can not learn how it came or what induced it. The season had not been

excessively warm, and was quite dry. It has not been general in the county, but has appeared in isolated localities. The per cent. of loss is necessarily light, while in a few localities quite large, possibly 25 per cent.

HOWARD.—Some few hogs have died of cholera the past year. The symptoms are a swelling of the head and a droopy appearance. The disease is not so general this year as usual.

KEITH.—There is no hog cholera in this county, so far as I have been able to ascertain. No disease of a contagious character has prevailed among any class of our farm animals during the past year.

LANCASTER.—The first appearance in this county of hog cholera as an epidemic disease was in 1884. It came from the north and progressed south at the rate of 60 to 100 miles per year. The cholera was the first disease which ever caused serious loss among swine in the county. The disease seemed to progress from one herd to another in an unaccountable way, sometimes passing over two or three farms to one beyond, and then attacking them later; but few herds escaped entirely. At present there is little complaint of cholera, or any disease among hogs. Cattle and horses have been exceptionally healthy during the past year, and owing to favorable weather since feeding time their condition is above the average.

LOUP.—There are no diseases and never have been among either horses, cattle, or hogs since the organization of the county, which has been about five years. I don't think a hog has ever died with cholera in the county. Cattle appear to be very healthy. There is once and a while a calf that dies with a disease called black leg.

MERRICK.—About six years since a disease came among hogs, and those who had large herds lost heavily. Some named it hog cholera, others effects of worms; some persons who had moved here from Illinois declared that it was nothing like what people called cholera in that State. The disease has been more or less prevalent ever since. A great deal of money was spent in the way of remedies, but without avail. I have noticed that persons who get hogs at a distance from home, for instance at public sales, etc., and the hogs at both places are healthy when the new comers are brought in, the disease breaks out, and these instances have not been few. A year since the disease got among my hogs. I tried about everything; every morning I found from 2 to 4 dead; and a man newly from Iowa told me to feed lime. The same day I put some lime in their slop, and I know that I have not lost a hog since. I had lost 50 in about four weeks. The disease is still about, and a great many name it cholera, but I can not tell what it is. I still feed lime.

NANCE.—Cholera destroyed two-thirds of our hogs last year, taking every animal from some farmers. It commenced in August. I had 30 old hogs and 150 spring pigs in a brush pasture. Cholera took 8 or 10 old ones, and I sold the rest; saved about 40 pigs. Bred the sows in the same pasture this year, and had no trouble with cholera.

NEMAHA.—I can not inform you the exact year when hog cholera first made its appearance, nor how it was introduced here. Hogs were generally healthy previous to that. I have been, during the past sixteen years, deeply concerned in raising hogs, and have met with severe losses therein. My conclusions are that the disease is unpreventable, and can be mitigated only by keeping the animals in better health. An undue proportion of corn and bad sanitary regulations are the main causes of excessive losses. There are no prevailing diseases among either cattle, horses, or sheep this season.

NUCKOLLS.—Hog cholera was brought into this county in the year 1884, from Iowa, by shipping in thoroughbred hogs, and has been here since, more or less, all the time.

PHELPS.—A great many hogs have died in the county the past year. It seems that people can not find any remedy for the disease. They have tried all remedies without success. Horses, cattle, and sheep have been very healthy.

PLATTE.—Hog cholera first made its appearance here in 1883-'84. Its first appearance was near railroad stations, and was probably brought here in stock-cars from diseased localities. Previous to the above date hogs were in a healthy condition, but since that time there have been thousands of hogs lost with the cholera and plague.

RED WILLOW.—Comparatively no hog cholera in this county this year. Early in the summer some shipments into the county of small lots brought hog cholera, but it was soon stamped out, and at present there is no complaint.

SEWARD.—Hundreds of hogs have died in this county from the ravages of cholera in the last four months, and about one-fourth of the living hogs in the county are affected with it now. It is proving very fatal.

SHERIDAN.—Not any hog cholera in this county. No special disease has manifested itself among any class of farm animals in this county.

STANTON.—Being a great cattle-feeding section of the country there are, of course,

a great number of hogs raised to follow cattle. Hog cholera had never been heard of here before 1882, when it first appeared and raged for some two years, almost every farmer suffering from it. Having had some experience myself, and from all I can hear in addition, I claim that worms have a great deal to do with it; and another important thing is that it usually originates among hogs that have not been properly taken care of, and spreads from them to others. Clean food, clean water, and clean pens, and not too many together are essential, I think, to keeping them healthy. I also believe that hogs dying are very often spoken of as doing so from hog cholera, when there is no such thing as the cholera about. There is one particular reason for hogs dying which I wish to give, and which is very often imputed to hog cholera in this section of the county. Being very cold in winter hogs pile up in their sheds, get thoroughly boiled, as it were, and then go out into the open air to eat. They naturally catch cold, and sicken and die. Another great mistake, in my opinion, is putting hogs into a feed lot with cattle when too young. I don't think they should be put in until they weigh 40 to 60 pounds, or, in other words, are large enough to "hustle" with those of a larger size, and to get out of the way of cattle.

THAYER.—Cholera prevails among hogs in this county. The symptoms are dullness, prostration, hiding under the litter, unwillingness to rise, hot, dry skin, sunken eyes, unsteady gait behind, impaired appetite, ardent thirst, and increased temperature, with much heat and soreness of the skin, with red patches and black spots. The tongue is thickly furred; a hard, dry cough is frequent. Have received good results from feeding well-boiled rye or barley, or corn-starch made with boiling water. As a preventive bury the carcass, thoroughly disinfect, watch the swine for the first sign of illness, and separate, if possible, from the herd as soon as first sign of disease is observed, and feed charcoal, soda, carbolic acid, or sulphate of iron to the healthy ones as a preventive.

WASHINGTON.—As near as I can ascertain hog cholera made its first appearance in this county about fourteen years ago. As to the mode of its introduction I have not been able to determine, but believe it to have been introduced by the importation of diseased stock hogs from the East. Having lost heavily by its ravages I have made it a point to find out all that I could in regard to it, both by observation and the experience of others. That it originates in the hog from the effects of a parasite there is no doubt. There is plenty of proof that crows will spread the disease by means of the parasite adhering to their feet, legs, and feathers. During the summer months, when they are nesting, the disease spreads but slowly. In the fall they flock in countless numbers to the pens where hogs are fed, and soon it spreads with increased rapidity. Last fall there were but few crows and but few cases of the plague in the county. This fall they are very numerous and many are losing large numbers of hogs. People here believe as long as there are crows there will be hog cholera, or, in other words, as long as crows have access to the pens the disease will last. We have tried all the remedies within our reach without avail, either as a cure or preventive. Hogs were considered as being very healthy previous to the advent of cholera. Those who have kept their hogs in close quarters (from diseased hogs and crows) have not lost them, but this mode is impossible by those feeding cattle.

WAYNE.—For thirty years I have been raising hogs and have paid my full share of hog-cholera (so-called) tax. I claim there are more hogs die of lung trouble than all other diseases combined. I have long since come to the conclusion that the hog disease is all right. My experience is that we get about as many dollars for a half crop as a whole one, and the dollar seems to be the one thing sought after. Three years ago this fall, I think, the disease struck our county. It found a poor man in the east end of the county with 120 young hogs. It took all but a few. He never knew where it came from. It went among his neighbors' hogs and spent its fury. Since that time it has been in different parts, until it has been over the entire county. Almost all have lost a greater or less number. We have 175 hogs now. About ten days ago they were attacked, and we will no doubt have less in the next ten days. Some lose the use of their limbs; some are purged; some are constipated, dull, and stupid, lie in their beds and grunt, and finally die. It is common in our neighborhood to save about 50 per cent. Occasionally a poor man loses all. Now and then we find a smart "Alec" that has a cure or preventive, but when his hogs are attacked they, like other hogs, die. Three years ago I bought 100 head 20 miles away, from one man. He kept 32; 20 soon died. Mine all grew to be fat hogs.

WEBSTER.—There has been no hog cholera in this county this winter, but there was some during the summer and fall. A good many hogs died of the disease. There is no other disease among hogs.

WHEELER.—We can not follow the track of cholera in hogs very well in this county. It seems mostly to be confined to the low lands in the river valleys. On

the high land no disease has been known this season, perhaps on account of but very few animals being kept in lots together. The hogs that have died have usually commenced by vomiting, and gradually lost flesh and strength. Some few have died quickly after the first attack.

YORK.—The first cases of so-called hog cholera within the limits of this county were in the fall of 1880-'81, prior to which there were no diseases among swine. The symptoms were loss of appetite, cough, emaciation, then diarrhea, soon followed by death. But a very small per cent. of the sick ones recovered. It is not known how it was first introduced into the county. It may be that there have been some cases within the county ever since. I know there have been for two years past. Hog diseases assume different forms. In one locality the hogs lose the use of their hind parts, break down, break out in large sores, and drag themselves about till they die. On examination it has been observed that none of the internal organs show any symptoms of disease except the intestines. In every case that I have examined worms were present, in large quantities. Many lots of hogs are kept in small inclosures, but these are not generally affected by disease sooner or more severely than those on clover pasture and large range.

NEVADA.

CHURCHILL.—There has never been any hog cholera in this county so far as I know. Hogs have always been very healthy, with the exception of some few that were afflicted with sore throat, which we called quinsy.

ELKO.—Hog cholera is unknown in this county. Horses in high elevations are frequently affected with kidney diseases, which often prove fatal. Fat cattle frequently die of the disease known as black leg.

LYON.—No such thing as hog cholera is known in this county. Not one hog in a thousand dies except from natural causes.

ORMSBY.—Hog cholera is at present unknown in our section of country.

SALINE.—In regard to the disease commonly called hog cholera I have to say: Previous to its first appearance in 1884 hogs were very healthy; indeed, a sick hog was almost unknown. In 1885-1886 there was a great loss, and it seemed to defy all endeavors to stop it. What would stop it in one place would not in another. There were many remedies tried, but no one thing to my knowledge proved in every case successful. In 1887 there have been but very few cases. We now consider it one of the things of the past.

WASHOE.—Hog cholera has never been known among hogs in this county. From 1 to 2 per cent. of the sheep in the county are annually lost by grub.

NEW HAMPSHIRE.

CHESHIRE.—Cases of hog cholera in this county are very rare. I am unable to hear or learn of any cases that were clearly of this disease that have occurred during the year. Stock of all kinds are and have been in healthy condition, and no more losses have occurred than are usual in the course of years, and these from a variety of diseases and conditions.

GRAFTON.—The disease of hog cholera never has to my knowledge been in this county. Hogs here are generally healthy. As to the care and general condition of farm animals I am happy to say farmers are giving their stock of all kinds better care and better keeping than they did a few years ago. The past year has been one of general health among our domestic animals. There was an unusual loss among young colts by death at foaling.

HILLSBOROUGH.—No case of hog cholera in this county has come to my knowledge the past year. Early in the season some 10 or 15 head of cattle were affected with what was supposed to be a contagious disease, but upon investigation it proved otherwise.

ROCKINGHAM.—There is no hog cholera in this county. This class of farm stock is generally healthy, as are also all other classes of farm animals.

SULLIVAN.—There is no hog cholera, nor any other disease that has attacked swine in this county the past year.

NEW JERSEY.

ATLANTIC.—One of my oldest correspondents writes: "It has been at least thirty years since the first case of hog cholera made its appearance in this county. I do not know how it was introduced, but previous to that time there had been few cases

of any disease. Since its introduction it has prevailed to some extent every year, sometimes amounting to an epidemic, at other times only isolated cases have occurred. There has been no remedy discovered. If the animals do not die at once they are almost worthless afterwards.

CAPE MAY.—The first case of hog cholera within the recollection of any of your correspondents for this county appeared about thirty years ago, when some portions of our county suffered badly from it. Since that time there has been more or less of it each year, perhaps less this year than for several years past. Do not know the means or mode of its introduction; hogs were generally healthy previous to that time. A disease appeared about the first of August among horses, which seemed to baffle the skill of all veterinary surgeons within our reach. Some called it "spinal meningitis," others "brain fever," and still others the "blind or stomach staggers." It carried off horses very rapidly, and lasted until cold weather set in. Horses attacked seemed to be taken with paralysis of the bowels and kidneys, so that no passage could be had. In most cases it proved fatal.

CUMBERLAND.—A peculiar horse disease was prevalent in the low, marshy sections of this county the past autumn. Most horses afflicted with it died in a few days. A *post mortem* examination showed either a diseased brain or lungs in all instances. Very few horses recovered. The hog cholera was not quite so prevalent or so fatal for the year 1887 as a few years prior to that time. No general cause for the disease can be assigned. In one instance hogs living on butchers' offal were affected; in other instances hogs kept under most favorable conditions, and remote distances from others, were quite as seriously affected.

GLOUCESTER.—There has been more of hog cholera in the southern part of this county than has existed for several years. It began about the first of April with some farmers. After nearly all their hogs had died the disease would seem to have run its course. Then it would locate in another neighborhood and run a similar course. From the best information I could gather, the loss in the county has been about 800 head of hogs and 400 pigs. In most instances the hogs affected with the disease were those running to pasture and having access to plenty of run water. In one particular instance, where one farmer lost 3 brood sows out of 4, the sow that did not die had 4 pigs, all of which (and the sow) remained healthy. They were at pasture away from the buildings, having a range of over 40 acres of farm land, meadow and timber, with a rivulet of water. They had access to it at all times. The hogs were affected differently; some with bowels very constipated, while others would scour until death relieved them. They did not linger long or lose much flesh, while those constipated would linger a long while and in some instances recover. The Bragdon remedy was tried by different farmers, but did not prove a success with any.

MERCER.—The disease which attacks hogs and is generally fatal to them, known as cholera, has been quite prevalent in the northern part of this county this last fall. It has been thought that a person could carry it on his clothes from an infected herd to a healthy one. Healthy animals, after being visited by those who had been where diseased animals were, have often been suddenly attacked. Almost all remedies are of no avail, as it generally proves fatal. If an odd one now and then should recover it is left diseased in some way, generally with a sore somewhere. It has prevailed here for a number of years, worse in some seasons than in others, but proving fatal almost always to the whole herd. I one year had a splendid lot of poultry, numbering over 200 head, sound and healthy in every respect. A friend visiting me was looking at them who at the time had cholera among his fowls. In ten day's time I was wheeling mine out from under the roost by the wheelbarrow load at a time. I sincerely believe he brought the germs of the disease in his clothes. Two cases of pleuro-pneumonia were reported, but the animals were at once killed.

MIDDLESEX.—Hogs have generally been healthy here. There has been no cholera that I have heard of, and no disease prevalent. Of course some have died. Sheep generally healthy; a little foot-rot. There were a few cases of pleuro-pneumonia among cattle, but the State officials slaughtered the herds in which it prevailed, to prevent its spread.

MORRIS.—Fifty years ago hog cholera was scarcely known; hogs were procreated, fattened, killed, and eaten as one of the healthiest meats then known. About twenty-five years ago hog cholera insidiously made its appearance in this county. From whence did it come? Not from far. The disease generated itself from bad feed, slop drinks, offal from wastes contaminated with insects, corn and grain with smut and ergot, indigestible cobs mixed by grinding, closed pens, and a deficiency of alkali. What results therefrom? The eaters of the pork have taken many diseases, and many diseases are constantly baffling the skill of physicians in their practice among the people. How to prevent? Previous to this disease hogs

were generally healthy. They had grounds to root in, impregnated with alkali from the burning timbers when clearing the lands; corn that was not assorted and the poor only given for feed. Cob was unknown to grinders of feed, and offal went into manure heaps. Their hogs were healthy, the eaters of pork were healthy. How to prevent this disease every grower of pork should know. Give brood sows and pigs more room, healthy air, healthy feed, less slop and waste containing too strong acids, and once every week put in the troughs wood ashes with small chunks of charcoal, mixing therewith a small quantity of flower of sulphur. The porkers will eat, grow healthy, and the cholera will not appear.

SALEM.—Hog cholera has prevailed in some parts of this county, and a large percentage of the animals have died. Very few cattle are raised in the county. Aside from a few choice Jerseys and Holsteins, our cattle industry amounts to but little.

SOMERSET.—Only a few hogs have died the past year. The disease affecting them was not reported as cholera.

NEW MEXICO.

BERNALILLO.—Hogs are not raised in this county, except where fed solely upon swill from hotels, etc. They are not subject to disease. I do not know of any hog cholera in the county.

SAN MIGUEL.—I have never known of a case of hog cholera in this county. A good many mares and colts die from eating the poisonous loco weed.

NEW YORK.

ALLEGANY.—There is no hog cholera in our county. No contagious disease prevails to any great extent among any class of farm animals. Some distemper or strangles has prevailed among colts. A few cows have died of milk fever and a limited number of sheep from foot-rot.

BROOME.—Hogs are only kept in our county in sufficient numbers to consume the refuse of dairying. Hog cholera is unknown here. The past year has been a marked one for the absence of diseases among all classes of farm animals.

CATTARAUGUS.—I have been unable to learn of a case of hog cholera in this county the present year. All domestic animals in this section have been remarkably free from disease during the past year.

CLINTON.—I have the pleasure to report that, as far as I can learn, there is no disease among horses, cattle, sheep, or hogs in this county. All generally healthy.

CORTLAND.—Neither cholera among hogs nor pleuro-pneumonia among cattle has ever visited the above-named animals in this county.

COLUMBIA.—Hogs in this county have not been affected with cholera.

DELAWARE.—We have not suffered from hog cholera in this county. Pleuro-pneumonia broke out in the town of Walton during the summer and created much alarm. Some 40 head were slaughtered and a vigorous quarantine maintained for quite a length of time. All danger is now passed and quarantine removed. The action of the authorities in endeavoring to stamp out this disease was severely criticized in some quarters; but all reflecting men were satisfied, I think, that vigorous measures were required, and certainly the results warrant the action taken.

GENESEE.—I have never known a case of hog cholera in this county only when imported in Western hogs, and it has not extended. I am sure it has never existed here only as above stated. From long observations and experience as a farmer I would judge that we lose 5 per cent. by disease, but mostly isolated cases, and few from contagious or infectious diseases. Domestic animals are generally well cared for and kept in growing condition throughout the year. Our pastures were short this fall, but stock is now nearly up to the average condition.

GREENE.—We have never had any hog cholera in our county or any contagious diseases among our cattle. None among horses excepting epizooty, and scarcely any losses from that. Our cattle, sheep, and hogs are all sheltered and well cared for and in a prosperous growing condition.

ERIE.—There never has been any hog cholera in this county. Swine are in their usual health, with no epidemic existing among them.

HERKIMER.—This county is remarkably free from any contagious diseases of domestic animals. No hog cholera, known as such, has appeared. Very little is now known of abortion in dairy cows; formerly it prevailed to a large extent. No prevailing diseases among horses, except occasionally some kind of distemper, limited in numbers and duration. Cases of disease are so rare that it is impossible to give any reliable data as to number, values, etc. As to the number of animals raised in our county, no satisfactory reply can be given; nothing short of a census

would be reliable. Averages, as compared with other years, can be quite reliably given. Much reliable information could be obtained by the appointment of a correspondent in every town in the county, if such could be obtained.

ONONDAGA.—There is no hog cholera in this county, nor has there ever been according to all statements of our best veterinarians. The mortality among hogs is very light.

ORLEANS.—There has been no disease among hogs this season so far as I can learn. Last fall and winter a disease supposed to be cholera appeared in this section. The hog became sick and after a day or two would break out with red rash on the skin. The first symptoms were the turning of the ears of a dark color, then loss of appetite, and after a few days death. Whatever this disease was it seems to have mostly subsided.

OTSEGO.—We seldom hear of a case of cholera among hogs in this county.

PUTNAM.—I can hear of no hog cholera in this county. A few years ago some droves of hogs were sold through this county and a large portion of them died from some cause or other, but the disease, whatever it was, died with them.

SCHUYLER.—Our county has never been afflicted with hog cholera or any other epidemic disease among hogs. The only disease that has prevailed to any extent among horses is common distemper or strangles, and it has not been as severe as in previous years, but few deaths occurring from that cause. Most of the deaths were caused by pneumonia and spasmodic colic. No epidemic disease has occurred among cattle. Most of the deaths were caused by milk fever and parturient apoplexy. No epidemic or parasitic disease has prevailed to any extent among sheep. The common sheep tick has been allowed to exist in some flocks, through the carelessness of flock masters. A mild epidemic of catarrh prevailed in the latter part of September and fore part of October, which caused no deaths except in old dilapidated sheep and weak lambs.

SUFFOLK.—Hog cholera, or a disease similar to it, has existed in this county for, say, the last fifteen years. We can not ascertain the date of its first appearance, but hogs are kept so isolated that the chances of contagion are small. Almost every farmer or villager that owns hogs keeps them confined in pens, often with only one or two in a place. The first losses, and most of the subsequent ones that we have heard of were when the hogs were fed on the refuse of large hotels, and kept in a filthy condition.

SULLIVAN.—I can not learn of any cases of hog cholera having appeared in Sullivan County the past season. There is not pork enough raised in the county for home consumption, the farmers being mostly engaged in dairying and stock raising. What hogs are raised are fed largely on skim milk, and allowed to run in pasture during the summer season, thus avoiding in great measure the causes which, in my opinion, produce hog cholera. I have not the necessary information concerning the number of domestic animals in the county, but according to the best information there has been an increase of 1 per cent. in horses and 3 per cent. of cattle and sheep since the last census.

TOMPKINS.—Hog cholera first appeared in this county about six years ago. The mode of its introduction is not positively known. Hogs were healthy before the introduction of the disease. A few cases of tuberculosis and many cases of acute distemper have occurred among horses. A few animals have died. Improvement from year to year in the care of live-stock is noticeable.

ULSTER.—There is very little if any sickness prevalent in this county among the hogs. There have been a few sporadic cases of cholera, and the total losses have been small. Horses are largely brought from other parts; comparatively few are raised in the county.

WARREN.—The disease known as hog cholera has not appeared in this county, nor is there any other disease prevailing among these animals.

WAYNE.—I have no information that leads me to believe that there is now, or ever was, a case of hog cholera in this county. Careful inquiry has failed to discover any information leading to such belief. Hogs are sick and die sometimes—always have. A sick hog is considered the very worst or most difficult animal there is to treat. For the past fifty years there has been a steady loss of from 3 to 5 per cent. in the county. But nothing of the cholera order, such as is reported from the Mississippi valley, has ever prevailed here.

WYOMING.—Have known but few cases of hog cholera in this county, and they were from importation in 1886. The death of those wiped out the disease.

NORTH CAROLINA.

ALLEGHANY.—Hog cholera was introduced in this county in the year 1862. Some years quite a number of hogs have died, while in others very few. I am unable to tell with accuracy how it was introduced. This year the disease has been very fatal.

Mostly large, fat hogs, ready for killing, have died. No special remedy as yet has been discovered. Some think burnt corn and bread crust in slop is a preventive, as the hogs of some who have been trying it have escaped.

ASHE.—Hog cholera has not been very destructive in this part of the country until the last seven or eight years. The health of hogs was generally good previous to that time, with the exception of something like quinsy. A cure has been effected by the use of strychnine.

BEAUFORT.—Hog cholera has prevailed in this section of North Carolina for the last twenty years, but has been much more prevalent for the last seven years. I am unable to give any facts in regard to its first appearance, and can not fix the precise date. The disease generally makes its appearance in the latter part of the summer or early autumn, and abates during the winter. But this year it prevailed extensively during April, May, and June, but has not done much damage this fall. It usually spreads from the starting point to the adjacent farms until the whole neighborhood is infected. I have been raising hogs, in considerable numbers, for the last twenty-five years, and did not lose any from this disease until 1884. It then came from a farm lying on the west of mine, the side from which the prevailing winds come. My hogs were not in contact with any that were sick, and were unusually thrifty until the disease appeared among them, which was in December. For two months prior to that they had the range of a large field, in which there was an abundance of pure running water, and their food consisted of corn, sweet potatoes, and field peas. In a short time 54 valuable animals died, among them 7 fine brood sows; several others which had been sick and apparently recovered died when the weather became very cold. Only two that were sick fully recovered. Their lungs were the organs affected. In the fall of 1885 I lost about 30, and in 1886 about 60. In August of this year I fed my hogs, in their food, carbolic acid for twenty consecutive days, and have had but one case. That was pronounced; the hog died, but the disease did not spread. The disease is less prevalent this fall than for several years past. The value of the annual losses in this county for the last seven years has been from \$10,000 to \$15,000.

BERTIE.—Hog cholera first made its appearance here some fifteen years since, and was at first confined to limited localities. It has since extended to the whole county. It is more prevalent during the fall and winter months, and the proportion that "survive" to be of value is hardly appreciable. No remedy has been found that will relieve or which cures. Thrifty, well-kept hogs are as subject to it as the weakly, ill-fed, indifferent ones in appearance. I have noted that pigs from one month to four months old are but little given to it.

BLADEN.—Hog cholera made its appearance here about 1861. Prior to that time hogs were very healthy. As to its cause no one can give a satisfactory answer. No remedy has been discovered. Prevention seems to be the best, and this is done by keeping healthy hogs from mingling with diseased ones. But this is very difficult, as stock are allowed to run at large. Those who pasture, and thereby prevent indiscriminate mixing of stock, are more successful in raising hogs.

BURKE.—We had hog cholera in 1864. I do not remember that we had it before that time. Hogs were generally healthy before the introduction of cholera. I do not know the means of its introduction. It has prevailed several seasons since. A good many animals died last spring. Some thought the trouble was caused by hogs eating sprouted acorns. I do not know the cause, nor do I know any remedy.

CAMDEN.—Hog cholera has prevailed only to a limited extent this year. Very few farmers have lost their hogs. Farmers have learned that by the use of turpentine and kerosene the disease can be cured. By strict and prompt attention the disease is in most cases checked in its incipency, and is not so destructive as formerly. Occasionally swine are attacked with quinsy, or something like it, which is more fatal than cholera. Twenty years ago swine needed no attention except to be fed, as disease was unknown. But farmers have learned that great care and attention are necessary in order to raise them successfully and profitably. I think the cholera first appeared in this county in 1867. No disease has prevailed among stock of any kind during the year, and the death rate has been nominal. The percentage of increase is about an average, except in sheep, which is rather above an average.

CARTERET.—Hog cholera was unknown to this county twenty-five years ago, but about that time it raged as an epidemic here, killing a large number of hogs. For twenty or more years it left us free from its ravages, but in 1886 it again appeared as an epidemic and killed 75 per cent. of all the swine in the county. Its infrequency along the coast in this county has been attributed to the saline and alkaline food eaten by our swine.

CASWELL.—But very few hogs or stock of any kind raised in this county. Only a few deaths among hogs. No cholera of consequence. In the past we have had

more cholera than in the last year or two. How it first came here I have no idea. It never was very bad here. In fact, we raise but very few hogs. No special disease has been among the horses or cattle; but few deaths have occurred, only from old age or worn-out horses. The same as to the cattle. Can not give anything like a correct idea of the number raised, of those that have died, or the value of the same.

CHATHAM.—Hog cholera has prevailed in this county more or less for the last twelve years, being at times much more fatal than at others. Especially was this so on its first appearance, when it was more fatal and destructive than it has ever been since. The nature of the disease has remained all the while a mystery, no remedy ever having been discovered that was infallible. With my own hogs thus infected I have found nothing that does so well as drenching them with a heavy dose of salts, repeated until looseness of bowels is shown.

CHEROKEE.—Cholera first made its appearance among hogs in this county about the year 1866, many farmers losing nearly their entire herd. The cause of its first coming was unknown. It makes its appearance now every few years, destroying nearly all the hogs during its visitation. Other farm animals are free in a measure from all disease. Hogs were generally healthy before cholera first made its appearance.

CRAVEN.—Hog cholera appeared here about twelve years ago. All classes of farmers have suffered from it. No remedy of universal, or even moderate, success seems to have been found. The writer is convinced, from observation and experience, and also from the testimony of many reliable men, that the danger can be reduced to a minimum, at small expense and trouble to the farmers, by the following plan: Take 1 bag salt, 1 barrel hard-wood ashes, and 3 pounds sulphur, mix and keep a supply of it in a bed or trough, under cover, accessible to the hogs every day in the year; also place charcoal where the hogs can get it. This will prevent an attack of cholera. It will not cure it, but will prevent it.

CUMBERLAND.—Hog cholera has not been very prevalent in this county this year, but was very fatal last year, and the stock has been so reduced that the lost percentage has not been regained. We think the hogs of this county are in a very healthy condition, but most of them are quite small because young. Hog cholera began in this county many years ago, and during 1885 and 1886 was very destructive.

DARE.—Hog cholera first broke out here in 1877, having been brought in from Camden County, N. C. It killed about one-third the hogs in the county. It broke out again in 1883, but not so bad as before. Since then we have had none except among hogs which stay on the beach and get their own living without shelter.

DURHAM.—We have had no hog cholera in this county for four or five years, or at least very little. The writer is unable to even approximate the date of the first appearance of the disease in this part of the State. We had a disease among hogs before the war, called distemper, which prevailed at certain seasons of the year, along in July and August. Our people do not raise more than one-fourth of the pork that they consume. They are now trying to raise more. When our hogs died of cholera several years since no successful remedy was discovered or used. Many think that one of the best remedies used was something to keep their bowels open.

EDGECOMBE.—Hog cholera made its first appearance in this county about 1863, and since that time it has made great ravages among our swine, often killing as many as 90 per cent. of a lot of fattening hogs. Pigs and sows have not been exempt. It has been very disastrous in some sections. It attacks old and young indifferently. It is considered by some that it is not so severe and general as it has been in the territory where there is no-fence law, because farmers are required to give their stock better attention. Being compelled to keep them from running at large, they naturally look after them with more care. If this should prove so it will be fortunate. The coming year will throw more light on it. Have found no specific cure for the cholera.

GATES.—Hog cholera made its appearance in this county about 1870, and it has not abated in its severity since. At least one-half of all the hogs or pigs in the county die of the disease. Hogs seem to be more liable to be attacked when about six months old, although some die when quite young and others when grown and ready for market. How the cholera made its appearance here has never been ascertained.

GASTON.—I know of some hog cholera in this county, but it is not serious or wide-spread.

GRANVILLE.—Hog cholera made its first appearance in this county about 1858, but has never done much damage. Occasionally one or two farms would suffer, but it has never been general over the county. It is thought by some to be typhoid fever, produced by the filthy manner in which most hogs are fed, and it is said that

the disease has never originated among those hogs running in the forest and away from the barn-yard and kitchen. We have had no cholera this year.

GUILFORD.—The origin of hog cholera in this county is unknown, but it has existed in this county for fifteen or twenty years. It has not prevailed here to any great extent for about three years.

HARNETT.—Hog cholera has prevailed in some parts of this county, and has proved very fatal. There seems to be a very ill-defined idea in the minds of our people as to what hog cholera is; for everything in the way of hog disease is denominated cholera. It began to be common in some sections about twenty years ago. Previous to that time our hogs were generally healthy. It is not known how it was introduced.

HENDERSON.—Cholera was first brought into this county by hogs driven through here from the West about the year 1843. Hogs were generally healthy up to that time.

HYDE.—It is a difficult matter to obtain a correct statement as to the exact time hog cholera made its first appearance here; but, as far as I can gather from the citizens, it was between 1877 and 1880. Previous to its coming a sick hog was rare; and it has been growing gradually worse each year and more fatal particularly with pigs. They rarely ever recover. We are confident it is carried about by the buzzards. The hogs that die in this county are never buried or destroyed in any way, but scattered all over the county, wherever they chance to fall a victim to the disease. The buzzards are exceedingly numerous, and no doubt carry it from point to point. Some portions of the county have never been entirely clear of cholera from the commencement of the disease here. Our hogs are sick in no other way. Numbers of farmers have lost all they had.

IREDELL.—After a close observation for the space of twenty-five or thirty years we are about as ignorant of the disease called hog cholera as we were at its first introduction. There are some noticeable facts, perhaps, worth mentioning: First, that it always moves westward, never eastward; second, that it may prevail on one side of a stream and not cross at all; thirdly, it moves about 15 or 20 miles annually (sometimes much less than that); lastly, it rarely ever prevails in the same neighborhood two seasons in succession. Since the adoption of the stock or "no-fence law" it prevails only at the distilleries, and that only occasionally, and is engendered, perhaps, in many cases from the slovenliness of the distiller leaving slops in the stills until they become copper poisoned. I frankly confess that we know but little about the disease. All kinds of farm animals have been unusually healthy during the year.

JONES.—Hog cholera was unknown in this county before the war. The first I remember of it was about 1872, when it attacked the fat hogs in lots and pens, and the next spring hogs in pastures and those running loose in the woods sickened and died. The first sick hogs I remember were White Chesters. The disease is present every year. I keep my stock on my own premises, apart from all others, and so far I have escaped the disease. Dead hogs are allowed to stay right where they die, and I think sickness is spread in that way.

McDOWELL.—The disease known as hog cholera made its appearance in this county about the year 1860. We suppose the introduction of the disease to have been from hogs driven in from Tennessee. The general condition and health of hogs previous to that time was good. There have been no deaths from cholera this year. Among other animals there has been but little disease except an occasional case of distemper among cattle.

MECKLENBURG.—There has not been any hog cholera in this county for several years. The first cases of cholera date back at least forty or fifty years; but I can not say how it originated. So few hogs are raised now that cholera is very seldom heard of.

MITCHELL.—I don't know that we have had hog cholera in this county for ten years past. Sometimes a hog dies, but more die from quinsy than from cholera. It first made its appearance here in 1866. Hogs were always healthy here previous to its appearance.

MONTGOMERY.—The number and value of hogs, as well as other stock, is taken from list-takers' reports for taxation January 1, 1887, and is correct as to numbers, but really below actual value. The cholera among hogs made its appearance very distinctly about the year 1883, perhaps to some extent earlier, but how it was first introduced is not known. Before its introduction hogs were comparatively healthy, and there was some profit in raising them, at least for home consumption. In 1885-1886 more than 50 per cent. died of cholera, and the loss was considerable before that time. During the first three months of this year there was considerable loss. Since then there have been very few deaths, and almost none recently, and the country is being stocked again very rapidly.

MOORE.—We have what we think is cholera among our hogs. We do not know the cause, nor have we any cure. Fat hogs, ready for the butcher, are as apt to die as any. Some farmers lose every one, whilst their neighbors sometimes do not lose any.

NEW HANOVER.—Hog cholera appeared in this county about 1854. Buzzards are supposed to be the means of its introduction by eating cholera hogs. No disease among hogs before its appearance. All the hog diseases are called cholera, but if it is cholera it has moderated considerably since 1854 to 1860. Herds of a hundred head would nearly all die in eight or ten days. The few surviving ones lost all their hair, which would be restored in a year. The symptoms were severe fever and sleepiness. We have met a party here who for the past four years has made a business of raising hogs. In 1884 he lost hogs from what he terms cholera, the symptoms of which were loss of appetite, then vomiting and purging, accompanied by stiffness of the legs. Death followed sometimes in a few hours, sometimes not for a week. In 1885 his drove was again attacked by the disease, and he used a remedy of his own, and was successful in every case. The remedy was used for only four days, when the hog showing conclusive signs of recovery it was discontinued.

NORTHAMPTON.—Hog cholera was unknown in this county prior to 1858. How introduced is unknown. Prior to 1858 a great many hogs were raised in the county and they were healthy. Am sorry to state that but little care or attention is paid to stock, especially cattle, sheep, and hogs.

ORANGE.—Hogs are scarce and high. We have had none to die this year of cholera.

ONSLow.—Cholera among hogs first made its appearance in this county in 1865. As to how it was introduced there is a great diversity of opinion. Before its introduction hogs were healthy and easily raised. There has been no epidemic among either horses, cattle, or sheep. Staggers killed a few horses and some cattle have died for lack of proper care.

PENDER.—Hog cholera appeared here in 1867. No one knows where it came from. Before its introduction into the county hogs were healthy.

PERSON.—The general condition of live-stock during the year is good, probably better than for many years past, owing, no doubt, in a great measure to the better treatment of stock and the large quantities of grain raised upon which to feed, keeping such in good order, and by a close watch in giving them such other nourishment needful, disease has not been so prevalent. As to cholera among hogs and its origin, I know but little. However, I will say from the best information obtainable it has existed ever since the year 1854. The first symptoms are shown by the hog seeking shade, failing to eat, pines away, and lives only a day or two. As to origin of this fatal disease I know but little, in fact it is not generally known. Some venture to say that the cholera was brought into the county by hog dealers coming in and selling pork to the citizens of the county, thus disseminating it.

PERQUIMANS.—We have quite a number of horses to die here some years with what is known with us as staggers. We have no cattle disease that is troublesome. Sheep are generally healthy, and do well when cared for properly. There has been a less amount of hog cholera in the county this year than usual. I think the first appearance of this disease was in 1866. It has been in the county ever since. Some years it is very fatal, more so than in others.

PITT.—Hog cholera made its first appearance in this county some time between 1850 and 1858. About 1861 it was quite general in the county. Previous to that time hogs were very healthy. Some physicians, and others, say that hog cholera is the same as typhoid fever in man.

RANDOLPH.—Hog cholera made its first appearance in this county in 1865.

ROBESON.—Hog cholera is intermittent in its attacks. It is milder some seasons than others, sometimes passing over a farm for several years. I do not know anything about it, nor does any one else, as far as I can learn. All other classes of farm animals have been quite healthy the past year.

ROWAN.—I have heard of no cases of hog cholera during the past year. This I attribute mainly to the fact that a few years ago this county adopted the no-fence or stock law, which requires every man to keep his hogs on his own premises and thus prevent the commingling of hogs and spread of disease. A few years ago we were frequently visited by what was thought to be hog cholera, and a great many hogs died from the effects of it. The disease was considered generally incurable. Some gave kerosene oil internally, and thought the hog could be cured provided the kerosene could be gotten into it soon enough after it was attacked. It is not known when the disease was introduced into this county.

RUTHERFORD.—About thirty-five years ago a drove of hogs from Kentucky or East Tennessee passed through this county containing hogs that were said to have

cholera. Several animals died on the road, and since that time we have had more or less cholera every year.

STANLY.—We have had no cholera among our hogs this year, but in 1885-'86 we suffered severe losses.

STOKES.—We have had no hog cholera for several years past in this county. It generally follows a heavy acorn crop, or mast. One of my assistants reports no hog cholera since 1871, when nine-tenths of the hogs died. Another, in the fall of 1867, when nineteen-twentieths of all the hogs died. Another says that no hog cholera has prevailed since 1889. Cholera was first known here in the year 1846. Supposed to have been caused by the terrible drought in 1845.

TRANSYLVANIA.—Hog cholera has prevailed here for more than twenty-five years. The year of its first appearance we can not give accurately. Previous to its appearance we had the disease known as quinsy, which killed a great many hogs, and did its work at short notice. I have no recollection of quinsy existing among hogs after the disease of cholera appeared. We had a drench of molasses and hog's lard mixed for quinsy, but cholera takes the field without a remedy. There has been no contagious disease among horses this year. Cattle have also been unusually healthy. The sheep business has been on the decline somewhat for the last two or three years.

WASHINGTON.—Hog cholera first appeared here during a hot, dry spell in the summer of 1874, and has always followed periods of drought since. Hogs that range on fresh-water creeks and sounds are least affected, while those in flat, swampy districts, where the swamps dry up, seem to suffer most. The disease is equally fatal in the upland portions of the county when water gets scarce. Previous to its appearance hogs in this county were very generally healthy.

WAYNE.—Hog cholera made its appearance in our county in 1859. It was very destructive that year. Where it came from and what caused it I do not know. Up to the above year hogs were generally healthy. There was some quinsy among them, Ours was a hog-raising county up to 1859. Since then hog-raising has been on the decrease, owing to this disease, which we have had more or less every year. Our losses from cholera will average 10 per cent. per annum for the past ten years.

WILKES.—Hog cholera has infested our county occasionally for many years past. Some think the germ was brought here from Kentucky by hogs that were driven from that State to this to slaughter. It has prevailed to a considerable extent in some sections of our county during the past season, killing a great many hogs.

WILSON.—I never heard of hog cholera here until since the late war. Of the 16,977 listed in June for taxation, I am satisfied 25 per cent. have died. It was very fatal this year. I lost half of what I intended to fatten in October and November, and I am satisfied that the loss from cholera alone is \$2,000 or more for the past year in this county. Previous to the introduction of cholera hogs were generally healthy.

YADKIN.—Hog cholera appeared in this county in the summer of 1867. It was said that it came here from Surry County by bringing hogs from there that were infected with a disease which no one suspected was cholera until the hogs began to take sick and die. From that it spread all over the county. Up to that time hogs were very healthy and doing well. As a general thing farm animals of all kinds are in good condition.

YANCEY.—Hog cholera made its first appearance in this county in the year 1846. It was brought here with a drove of hogs from Jefferson County, Tenn., and has been here every year since that time. I am informed by reliable old citizens of the county that hogs previous to that time were perfectly healthy.

OHIO.

ALLEN.—Hog cholera has prevailed in this county for about fifteen years. I can not give the exact year that it first made its appearance. It was introduced, I think, from Illinois, by bringing improved stock. Hogs before that time were healthy but of poor grade.

ASHTABULA.—Hog cholera is unknown in this vicinity.

ATHENS.—No hog cholera prevails in this county. With the exception of sheep, all classes of farm animals are healthy. Many young sheep die of "paper-skin" or worms in lungs and bowels. We have no remedy for this disease.

AUGLAIZE.—The first appearance of hog cholera here was about the year 1859. Those of the age of from two to four months suffered most. They were attacked with a high fever and had convulsions and jerkings, which by some were called the thumps. But few ever got well. In the early settlement of this county, before the cholera made its appearance, hogs were allowed to run at large in the woods,

and were not any healthier than they have been since they were kept in inclosures and on tame grasses.

BELMONT.—We had a few cases supposed to be hog cholera the present season. The disease was introduced by hogs purchased from other counties for breeding purposes. We probably lost one hundred head by this disease. This is the first year of its introduction in the county. Hogs were generally healthy previous to its introduction. We have no contagious diseases among horses, except distemper, which frequently occurs, and occasionally an animal is lost from the effects of it. But the greatest mortality is caused by colic. Cattle are generally healthy. The greatest loss occurs at the age of one year or less, generally at the age of six months. Symptoms: Loss of appetite, legs grow cold and become stiff, causing death in a few hours. Generally attacks those in good flesh. I have opened some of them and found the contents of the stomach and intestines to be caked hard. At first symptoms of disease, if not progressed too far, I gave copperas, followed by bicarbonate of soda, which gave relief in most cases.

BUTLER.—There has been no epidemic among farm animals in this county, except cholera among hogs, and this disease has not been so prevalent this year, as very few animals have died as compared with 1886. It is more than thirty years since this disease first appeared. It comes and goes like drought—some years it is wide-spread and destructive, while in others but few cases occur. I believe that if pigs were fed for the first six months on oats and bran mainly, and when fattening were fed on corn, pumpkins, or roots, the danger and loss would be greatly reduced. A correspondent writes: "Cholera, it seems, is the name of all diseases that hogs are liable to, yet this so-called cholera does not always affect the hogs alike. Sometimes they are costive; at other times they are the opposite. They run off at the bowels and thus lose flesh rapidly, and die in a few days; 75 per cent. of all that have cholera die. All advertised sure cures fail. In almost all cases the lungs become affected; some bleed at the nose." If they take the disease while fed on old corn they are costive. Feeding them on green corn will often affect a larger percentage of cures than anything I have tried. When a herd gets the disease the sick ones should be separated; this will often prevent the spread of the disease. From my own experience I have found that hogs allowed to drink water from a running stream of water will distribute the disease for several miles. I find that it is carried further by this means than any other. One of my neighbors' herds had the disease for several seasons. They were allowed to drink and wallow in the streams, and for several miles along said streams farmers that allowed their hogs to drink from it lost most of their animals. I made a request of them to keep their hogs from drinking out of this stream, and all that kept them from doing so, and gave them pure, clean well-water to drink, prevented an outbreak of the contagion. I commenced feeding hogs extensively the fall of 1846. I fed from 200 to 500 head yearly up to 1862, and up to that date I did not lose over 2 hogs per 100 head. The first year we had the disease in our county was in 1863. That year I lost 100 head of hogs out of a herd of 300 head. Almost the entire herd was affected. From that date up to the present time our county has suffered more or less each year. After testing almost all the advertised cures and preventives I find nothing better than to keep them from drinking impure and contaminated water."

CARROLL.—We have no hog cholera in this county as far as we can learn. If there is any it is kept a secret from us.

CUYAHOGA.—I never heard of hog cholera in this county until the past season. It was introduced last season by hogs brought in on the cars to stock the cheese factories in the eastern part of the county. Hogs were generally healthy previous to this time.

DEFIANCE.—The first appearance of hog cholera to my recollection was about the year 1877. At that time, and for several years subsequently, it prevailed pretty generally throughout the county. Many hogs have since been lost, but owing to better care and the keeping of a smaller number on each farm the disease has become less destructive. The few cases are generally where hogs are neglected or are kept in large numbers. One instance, where 42 were fed in a lot, 7 showed symptoms of cholera. They were removed a distance of about 3 miles to a new pasture lot and fed light feeds for two weeks. When the feed was increased, as they ate clean, in four weeks they were marked and were healthy. The remainder were also changed to new pasture, and after that none were taken sick. Horses have been affected to some extent with pink-eye and distemper.

DELAWARE.—All the inquiries I have been able to make have resulted in a failure to find a single case of hog cholera within the limits of this county. I am not able to say how or when the first case of hog cholera came into the county. The health of all kinds of animals is good. The loss by disease is very light, except, possibly, among sheep, which is generally the result of neglect.

ERIE.—We have had little experience with hog cholera, as we seldom ever hear of a case in this county.

FREMONT.—But few hogs have died of disease in this county during the past year. Perhaps \$1,000 would cover the losses among this class of animals.

FULTON.—Hog cholera was introduced into this county in the year 1875. It has been brought in several times since by stock hogs impregnated with the disease.

GALLIA.—Hog cholera prevailed during the year in but one township (Harrison) in this county, which resulted in a loss of 542 animals. The loss in this township amounted to about 50 per cent. of the loss for the entire county, from other causes, among this class of animals. There was a loss of 640 sheep. Of these 372 were killed by dogs. There is no generally prevailing disease among any class of farm animals.

GEAUGA.—There is no hog cholera in this county, and never has been. There is no special disease among any kind of farm animals.

HANCOCK.—A correspondent from the northwestern part of this county writes: "Hog cholera was introduced in this county in the year 1864-'65, by a shipment of hogs from the West by one Hiram Star, who unloaded them at Findlay and drove them through the county for the purpose of delivering them to feeders along the river and at various places through the county. In a short time after they began dying from a disease now known and commonly called hog cholera, which has affected the swine more or less every year since that time. Previous to that time epidemic diseases were unknown among hogs. Some claim that hog cholera is produced by close confinement, while others think it is carried in the air or by rats, etc." Another correspondent in the northwestern part of the county says: "About four years ago the disease known as hog cholera made its first appearance in our part of the county. At first the loss was light, but its fatality increased until last year its victims could be numbered by the thousands. We have found no remedy. The present season it has abated somewhat both in number of cases and in fatality." In Amandos, Madison, Jackson, and Delaware Townships the disease has done fearful damage. As to the number or the value I can only approximate. I can not express an opinion as to the nature of the disease. As to a preventive my opinion is that cleanliness, good food, and pure, cold water will do as much as anything that can be done.

HARDIN.—Several years ago hog cholera made its appearance in this county, and many of our farmers lost nearly all of their hogs. I had but two affected, and they were in a rather poor pen by themselves. I treated them with the sulphur remedy, but it did no good. They soon died, and turned purple almost as soon as dead. I was careful to bury them where no hogs ran, and commenced feeding the rest charcoal, and there was no more of it here, nor has there been any since that time. I think that if hogs run to the woods and have charcoal twice a week that they will not have the cholera.

HARRISON.—There never has been any hog cholera in this county. I know very little about it. From the best information I can get about 10 horses annually die out of 1,000 head; cattle, 12 per 1,000; sheep, 20 per 1,000, and about the same number of hogs.

HOLMES.—There has been no cholera in this county for several years. In 1867 or 1868 a few hogs died with a disease that was called cholera. Farmers generally let their hogs run in clover during the summer months, which, it is claimed, keeps them free from disease. Several horses affected with glanders have been killed during the year. A number of pigs have died of disease, and several cows of milk fever.

HURON.—There has been but very little hog cholera in this county for the last ten years; was very bad in Bellevue twelve years ago, in the distillery, where the hogs were fed on still slop. They lost over 1,000. They cleaned the pens out, sprinkled lime all over, let them stand empty for six months, then filled up again; fed part slop and part corn. The hogs fed with slop began to die, those fed with corn continued healthy. I do not know what was the cause, but there has been nothing of it since. I think if hogs could have what soft coal they would eat, with a little sulphur once a week, they never would have the cholera. I have over 100 head on hand now, and never lost but one with cholera. I keep from 100 to 500 head. I let them have all the coal they will eat, with sulphur once a week. Pink-eye has prevailed to some extent among horses. If not taken in time the disease is apt to prove fatal.

JACKSON.—Hog cholera in our county is unknown. Our hilly, rolling ground is conducive to the general health of hogs. They are always raised here in small lots, which is also conducive to their health.

LAKE.—No hog cholera prevails in this county that I have heard of.

LORAIN.—There never has been a case of hog cholera in this county, that is, so

far as I can ascertain. I do not hear of the prevalence of any special disease among any class of farm animals in this county.

LUCAS.—This county has had but very few cases of hog cholera, hardly enough to deserve mention. A few years ago some cases were reported.

MEIGS.—Hogs in this county have been remarkably healthy for many years. It is doubtful if a case of real hog cholera ever occurred in the county. All domestic animals, sheep excepted, have been very healthy for several years.

MERCER.—Never knew of a case of hog cholera in this county until after the advent of imported and improved breeds, from 1850 to 1860. Almost every year since its first appearance there has been more or less of its ravages—in a certain locality one year, and some other the next. Last year its ravages extended over a larger scope of territory than perhaps in any previous year. The counties of Wells and Adams, in Indiana, or at least a great portion of them, were almost depopulated of hogs. From this locality the disease passed in an easterly direction through the north half of this county, and the results were very fatal, many farmers losing their entire herds. The southern portion of the county was comparatively free from disease. As yet no reliable remedy has been discovered. As to the number affected by the disease, or the number that have died, I have no data upon which to base a report, and can do no better than to estimate from the best sources at hand. Horses and cattle are comparatively healthy this year. The north half of the county is not well adapted to sheep-raising. The farmers in the south half are giving considerable attention to the industry. As a general thing sheep are healthy.

MIAMI.—Hog cholera first became known in this county in 1849-'50. Some cranks claimed that the disease was introduced by Norway rats. Various remedies have been used. There seems to be no certain specific. Sulphuric acid and charcoal did well in many cases. About the year 1878, 400 head of hogs were brought to Troy from Kentucky, by Hagner and Frazier. Hagner kept his at Troy, in pens at his distillery, and nearly all of them died of cholera. Frazier drove his to his farm and turned them into a corn-field. The corn was just getting hard. He lost none. Other classes of farm animals are generally healthy.

MONTGOMERY.—Hog cholera appears at irregular periods in different sections of this county, and in some instances nearly entire herds are swept away by this disease, no certain remedy having as yet been found to save them. It is becoming well understood, however, that strict sanitary measures are of the utmost importance, and where vigorously pursued very little complaint is heard.

MORGAN.—There never has been any hog cholera in this county, it being a very healthy county for all kinds of stock. No animals of any kind die of contagious epidemic diseases. The only disease from which horses suffer here is horse distemper, which very rarely proves fatal. Cattle are not troubled with any disease, and sheep only die of old age.

MORROW.—As for hog cholera we have none in our county to my knowledge. We do not know that this disease has ever been within the limits of our county. No class of farm animals in this county have been affected during the current year with anything like a general or epidemic disease.

MUSKINGUM.—Hog cholera was first known in this county in 1833. Some few died on the Muskingum River from May to December. Its appearance was again made in 1842; also, in 1849-'50 to 1855. At no time was it so bad as on the Wabash River, Indiana, in 1830 to 1833, 1840 to 1845; up to 1870 it increased nearly 10 per cent. per annum.

NOBLE.—No disease of any kind has recently prevailed among hogs in this county. Horses have been affected to some extent with distemper, but otherwise farm animals have been healthy.

PAULDING.—I have lived in this county twenty years. In that time we have been visited with hog cholera three times. First, in 1875, it came in its most malignant form, killing hogs both large and small. If there was a hog recovered that was attacked with the disease I do not remember it. Again, about 1880 it visited us in a milder form. This time it only affected shoats and a few of those attacked recovered. Again, 1885-'86, it visited us in a more malignant form, some farmers losing every hog they had. How was it introduced? Like the boy's itch, "it just come." It made its appearance first along the streams, and appeared to travel up stream. Thinking I had learned something of the contagious character of the disease I thought to place my hogs out of its reach. I put them in an inside field where no other hogs could come in contact with them, and where there was no stream of water. The field had been used for pasture of sheep and cattle. I fed the hogs a little corn, gave them well-water to drink, and out of 24 head the cholera left me 4. Hogs are generally healthy this year.

PICKAWAY.—The first that I have any knowledge of hog cholera being in our county was, I think, in the year 1863. Almost every farmer that has had the scourge

in his herd has a remedy, and apparently can give the cause of the disease. But my opinion is that the man that claims he can cure it is a quack.

RICHLAND.—No hog cholera seems to exist in the county, nor has the disease prevailed to any great extent at any time. The greatest loss has occurred among horses.

ROSS.—There has been a great deal of complaint of hog cholera, but in many instances it has been swine fever or pneumonia. Lung worms have been found in many cases. There is a great deal of ignorance about the disease in hogs.

SENECA.—I am glad to report no hog cholera in this county during the past year, while Hancock, Crawford, and Sandusky, on our borders, are all reported as suffering from this contagion or epidemic.

SHELBY.—The number of hogs raised in this county this year was 20,900. Of this number 1,760 died, entailing a loss of \$6,735. There were 165 horses lost, valued at \$13,545. Two hundred and seventy head of cattle, valued at \$5,685, were also lost by disease during the year.

WASHINGTON.—There have been no losses from hog cholera in this county. No general disease has prevailed this year among this class of farm animals. Farm stock of all kinds is in good condition, and starting into winter quarters free from disease.

WARREN.—Hog cholera has been in our county since 1854. The health of hogs is good except where attacked by this disease. It generally is quite fatal with young hogs. As yet nothing has been found to cure the disease. The finer the stock the more fatal it is. It will attack a herd on one farm while the hogs on the next one will remain perfectly healthy. Cattle, horses, and sheep are in good condition.

WAYNE.—Hog cholera does not prevail in this county. No epidemic or contagious disease has prevailed to any extent during the year among our farm animals. Many Western horses have been brought in during the year. They are mostly improved draught horses, and are subject to distemper, influenza, and sore throats, of which some few have died. The general condition of live-stock is good.

WOOD.—Hog cholera has been in this county, off and on, for nearly twenty years past. It has been very bad in some neighborhoods during some seasons. There is some in the eastern part of the county, and also near the west side, this season. Some farmers have lost as high as 60 head. The disease prevails over a very small territory compared to the entire county.

UNION.—I can not learn when hog cholera first appeared in the county, but it has appeared in localities repeatedly in the last twenty years to my knowledge. The latter part of last year and the first of this it proved very fatal in some neighborhoods, though it did not spread very much. Hogs affected were generally secluded. When this was neglected it seemed to be communicated by contagion. A large number of heavy draught horses died during the year.

OREGON.

COLUMBIA.—I have lived here eight years, and have never heard of a case of hog cholera occurring in the county.

DOUGLAS.—I have been a permanent resident of Oregon over forty years, and of this county nearly thirty-eight years, and I have never heard of a case of hog cholera in the State. I am a tolerably close observer in all matters relating to domestic animals, and I think the above is conclusive that an exclusive corn diet is not so good for hogs as a mixed diet. Hogs in this State get very little besides grass until they are shut up to fatten, and then the majority are fed on wheat, or wheat and oats mixed—sometimes ground, but more in its whole form. I do not say there never was any hog cholera in the State, but if there has been I never heard of it, and I am a regular reader of the agricultural papers.

GILLIAM.—The hogs of this county are quite healthy; I hear of no disease of any kind. Scab has prevailed to some extent among sheep, but our stringent laws prevent much loss from this cause.

GRANT.—There is no hog cholera in this county, and never has been. I came here twenty-five years since, and have never seen or heard of a case of this or any other contagious disease among hogs. No disease prevails among horses, and cattle are healthy. Sheep are occasionally affected with scab.

KLAMATH.—As nearly all the animals enumerated are raised and grazed upon the public lands, many of them being remote from settlements and not generally looked after, except during the annual round-up, or during the period in which it is necessary to feed them, it is utterly impossible to ascertain the losses. So far as I can learn there has been no prevailing diseases among domestic animals, and the losses, either from wild animals, poisonous herbs, or disease will not exceed 1 per cent. of either class.

LANE.—I have lived in this county over thirty years, and have never heard of any hogs being affected with cholera, or, in fact, with any disease whatever. They are and ever have been perfectly healthy. I have raised and fattened many hundreds myself, and always found them in good health. Within the last four years horses have been troubled much in different parts of the county with two very bad contagious diseases—nasal gleet and glanders. They are both fatal. The animals refuse to eat and pine away and die in a short time.

MARION.—Hog cholera unknown in this county—never has been any. Care of stock generally better in the last year than formerly. No fatal diseases among stock to be noted.

MORROW.—We have no fatal disease of any sort among the domestic animals in this county. Stock of all kind are exceedingly healthy in this locality. The only loss sustained is during the winter season, but farmers and stockmen are annually making improved preparations for caring for stock animals during the winter season. The heaviest loss is reported from stock running on the range, which have no protection and but little feed during the stormy weather.

MULTNOMAH.—There seems to be no disease prevailing among the domestic animals of this county.

POLK.—Hog cholera is unknown here. Horses are affected sometimes with staggers, caused by bad treatment. Cattle are very healthy. Sometimes they die for lack of food.

WASHINGTON.—There has never been a case of hog cholera in this county. There has been absolutely no disease among the domestic animals of this county during the past year, and no loss save that incident to old age and lack of proper care and attention.

YAMHILL.—There has not been a case of hog cholera in this State that I have ever heard of. Hogs are very healthy, and there is no disease among them. The principal disease among sheep is scab.

PENNSYLVANIA.

ADAMS.—Hog cholera has appeared in this county as elsewhere, and in the same arbitrary fashion. We are as far as ever from ascertaining either its cause or cure. Often, in a circle of 1 or 2 square miles, it will appear and sweep away almost all the hogs, and outside of that there is exemption from it. The notion that it is caused by constant corn feeding and consequent enervation of animal's constitution is not always supported by the facts. Can not tell when it first appeared in the county.

ALLEGHENY.—We have no hog cholera in our county. Other classes of animals are quite healthy. One of my assistants in the northwestern part of our county speaks of pink-eye among horses, but it does not cause many deaths. We had some hog cholera about ten or twelve years ago. It was brought here from the stockyards at Pittsburgh. The hogs were taken to a distillery in the adjoining county. All healthy stock that came in contact with the diseased at that time was certain to have cholera. There are not many cattle or sheep fed in this county, as the industry is not profitable. We can not compete with Western feeders with their cheap corn.

ARMSTRONG.—No well-authenticated instance of the occurrence of a case of hog cholera in this county has come to my knowledge. Some twenty years ago a number of hogs fed on still-slop, at Freeport, Pa., died suddenly, and the disease was thought by some persons to be cholera, but most persons believed it to have been the result of injurious substances in the slop. Hogs, I think, have increased one-third in numbers. Fed on waste apples they are the only kind of stock that can be raised without loss.

CAMERON.—The disease known as hog cholera has never developed in this county.

CENTER.—Hog cholera has been known to exist in our county for the last thirty years, but to no great extent until within the last five years. Since then it has been prevailing and on the increase, and fully 50 per cent. of the hogs have been attacked and all of 40 per cent. have died. One reporter states that hogs that ran to clover pasture were most subject to it. We have tried many remedies, but no cure has yet been found.

CLINTON.—The first known of the disease called hog cholera in this county was about ten years ago. Since then it has twice visited us in a virulent manner, but I am of the opinion that it is lurking around at all times but in a mild form. The disease this autumn has been in a more malignant form than heretofore. Some die ere you know they are sick, others linger a considerable time and continue to fall away (although partaking of food) until reduced to a skeleton, when death closes the

matter up. Every person who has a pig to recover has an infallible remedy and preventive, but unfortunately the next pig requires altogether a different treatment. While a percentage gets over it without any treatment, many get the disease which never came in contact with any other hog, while frequently half the hogs in a pen will die and the rest remain perfectly healthy. So the source of the disease and a remedy have not yet transpired.

CRAWFORD.—I never heard of a case of hog cholera in this county, and no disease seems to be affecting any other class of farm animals.

ELK.—Hogs are not raised to any extent in this county. What are raised are usually kept in pens and fed on milk and refuse of the kitchens. They are killed at about a year old. Their numbers are not increasing. There has never been any hog cholera in the county.

FAYETTE.—I have lived and been engaged in farming on the place I now live over fifty years, during which time my hogs have had what is called cholera but once, that was about the year 1850. But there has scarcely a year passed in my time of farming that reports of hog cholera did not reach me, although our losses were seldom very great. Some of our distillery-fed hogs seemed to die off pretty rapidly, but in the general way a few would die, and some would linger for a time and finally recover, while a large percentage would escape altogether. The cause of hog cholera has never been satisfactorily given, nor has there been any infallible cure discovered. The disease at first seems epidemic and afterwards contagious. Upon the whole hog-raising is rapidly on the decline in this section.

INDIANA.—Hog cholera was introduced into this county in the summer of 1886 by hogs brought from "East Liberty" (Pittsburgh) stock-yards. It has so far been confined to three townships and losses have not been extensive. This county is very favorably located for insuring healthfulness in animals, particularly hogs. High and rolling land, abundance of pure running water, plenty of woodland and shade, etc. Personal observation of the disease in several instances has made it apparent that healthy hogs, if not too fat when attacked, under conditions above-named, will recover, at least a large percentage will. I note one instance where a herd of good hogs had been liberally fed on skimmed and butter milk, and every one recovered. The recovery was marked by loss of hair, and in some cases the hoof. Some pink-eye has prevailed among horses. Cattle and sheep are free from disease.

JUNIATA.—Hog cholera is thought to have been brought into the county about the year 1862. The probability is that it was introduced from the western part of the State and from Ohio, as many hogs were brought in at that time. It is not epidemic at present, and has not been for nearly a year. I can not find any one who can give the cause of its appearance. Sometimes it is ascribed to an overfeed of acorns, as it appears more prevalent in the years when they are a full crop. The remedies tried, with at least partial success, have been common salt, and charred corn-cobs, arsenic, tar, and asafetida.

McKEAN.—There is no prevailing disease among sheep. Nine-tenths of the deaths are the result of abuse and starvation. Hog cholera has never prevailed here.

MONTOUR.—Some cholera has prevailed among hogs in this county, but the losses have been light.

NORTHAMPTON.—There has been no hog cholera in this county worth speaking of. If farmers would adopt the plan of giving their hogs charcoal every week there would be no disease among hogs. There has been no disease among horses or cattle. Some of the latter have died of bloat from feeding on clover. We raise no mules or sheep. I suppose the value of animals lost by disease may not have been over \$5,000.

LAWRENCE.—Within the last ten years I have known but of a dozen cases of hog cholera, and I do not think any of them were cases of the genuine plague, which, I think, is only a Western disease. Hogs are too well taken care of here to contract cholera. They are raised only in small lots in our county. I imported some Poland China pigs some ten years ago from western Ohio. One sow died of what at the time was called cholera, but I am satisfied now that it was too fat, and died of kidney disease. Some die of pneumonia, superinduced by close feeding in warm, close pens. Some cows die of puerperal fever in consequence of being too fat when they calve. Dogs kill a good many sheep. Horses are generally healthy. More died from colic and over-driving than from any disease.

LYCOMING.—Hog cholera first made its appearance here in the fall of 1885. It broke out here shortly after half a dozen car-loads of hogs were shipped into the county from the West. It was not so bad in 1885, but in the fall of 1886 it was very bad, but this year I have not heard of a single case. People have been feeding good, healthy feed, and have been particular with their pens. Previous to the cholera I never knew of any hog disease in the county.

PIKE.—The disease of hog cholera is not prevalent in this county. It is very seldom that hogs ever die here of disease.

UNION.—Hog cholera appeared in the western part of this county in 1884. A few sporadic cases have since occurred. In the northern part of the county, in 1885, a number of hogs died, but it was not thought the disease was cholera. Some veterinarians called it anthrax. It has not yet appeared in the southeastern part of the county.

VENANGO.—Hog cholera is unknown in this county. We have had no prevailing disease among any class of farm animals.

WARREN.—I can not learn of the existence of any contagious disease among the horses in our county, except an occasional case of glanders, and such are usually destroyed as soon as the disease is surely identified. I know of no contagious disease among our cattle, sheep, or hogs. Three years ago a butcher in the southern part of our county bought about 20 Western hogs, and within a few weeks lost them all with what was thought to be hog cholera; but no other cases are known to have occurred in our county.

WASHINGTON.—We have had so limited a number of hogs affected with cholera that we know but little about the disease. All kinds of farm animals have been very healthy the past year.

YORK.—I regret my inability to furnish the Department with a reliable history of the disease known as hog cholera. I suppose, like many other diseases, little attention was at first given to it, believing that, like many other epidemics, it would of itself soon run out. But farmers have long since been convinced that the disease has come to stay, and a hog-killing one it is. From all the information obtainable, I infer that the disease first made its appearance in the county about thirty years ago—that it was brought here through the introduction of Western hogs, and that it was unknown prior to that time.

RHODE ISLAND.

BRISTOL.—Hog cholera prevails among hogs in this county. Weakness in the legs is sometimes apparent, but no serious casualties occur among hogs from this cause.

PROVIDENCE.—There is hog cholera in this county. There has been some in the northern part of the State.

SOUTH CAROLINA.

ABBEVILLE.—We have had no hog cholera during the year. A few sporadic cases of disease, caused no doubt from unhealthy food, have been reported to me by my assistants, who are scattered in various sections of the county.

ANDERSON.—Our hogs have been very little affected by cholera this year. Less than half that are affected ever recover. We rarely administer medicines, and know no remedy supposed to be curative or preventive. The date of its appearance here is very uncertain. It is probable that our people knew nothing of cholera at the time the disease was introduced here. It is generally supposed to have been brought into our county by diseased hogs from Kentucky and Tennessee, which had been raised and fattened on still-slops.

BARNWELL.—It is not known when hog cholera first appeared here, or its origin. About 1857 farmers in a few localities lost some of their hogs from a similar disease, but it did not spread then as since. For many years after there were no symptoms of it. Large numbers were in the forests and uncultivated fields, free from any disease whatever. In later years it went from place to place, seemingly without individual contact. We would hear of it 8 or 10 miles away, across large water ways, and in two or three months it would be among our own stock. It has crossed Savannah River, but was not carried by diseased animals. Hogs have escaped when fed once in two days on corn burnt to coal on the ear, and given greasy salt, or that from bacon boxes, with sulphur in shallow troughs where they had free access to it. They would eat this salt and reject clean salt. This is done before the disease reaches the locality and continued till its disappearance. Nothing cures it; we have heard that common soda will, but it has not been tried sufficiently to determine. A good many horses die every year from glanders.

CLARENDON.—I had cholera among my hogs in 1864. I tried asafœtida without effect. I tried it again in 1870. I had my hogs in a pasture, all in good order. One morning I found a fine sow dead. Several were drooping. I saw one rooting where

there had been a coal kiln. It was eating old coal with avidity. I thought this was the remedy; so I sent my wagon and hauled a four-horse load of light wood, put up two small kilns, burned them down, and watered them out before dark. The next morning when I went to feed all the hogs were eating charcoal. They ate it in preference to corn. They fed on it for about ten days, when they commenced to recover. I lost but the one. I give my fattening hogs charcoal, which they will quit their corn to eat.

GEORGETOWN.—The disease of hog cholera has been known in this section since 1874-'75. Has been usually very fatal, especially among young hogs; fat animals are not exempt. Within the past ten years it has invaded every township in this county, along the swamps as well as pine barrens, and around cultivated farms. In April, 1887, one of my associate correspondents, Col. R. Nesbit, a large rice planter, suffered after the disease had subsided in three adjoining townships. Out of 150 head of hogs he had 75 sick and lost 70, among them two valuable stock hogs (selected Berkshire). No treatment availed in checking or curing the distemper. Loss estimated at \$350. I have not been able to locate the disease in 1887 in any other section of this county, except sporadically, where it had existed two years before.

LAURENS.—We have a disease among hogs called cholera. Most of those attacked die. I can not tell when the disease made its appearance here. The first talk of cholera was about 1850 or 1860. More horses are lost from eating peas and from starvation and ill-treatment by negroes than from any other cause. Epizooty prevails sometimes.

LEXINGTON.—When a small boy, over fifty years ago, there were similar epidemics among hogs to that now known as cholera. It is possible that the closer confinement which has followed the stock law, with the stuffing process in feeding, may have aggravated the diseases which have always attended the raising of hogs; for I am satisfied that this scavenger is more or less diseased on account of its hog-gish habits and the foul food upon which it subsists. There has been a terrible visitation of the cholera, so-called, among the fattening hogs of this locality during the past month, and many have died. It was confined not only to fattening hogs, but attacked, on the same premises, those which had not been penned up for that purpose. The loss has been heavy, and I have no doubt the disease will continue its ravages until our people give up the idea of selecting stock hogs for their fattening proclivities.

MARION.—Hog cholera, or any epidemic of a serious nature among hogs, was unknown before the late war, and must have been introduced afterwards with improved breeds brought from the North and Northwest. There has been no epidemic this year, and very few have died; so few, indeed, that it will not be proper to report as much as 1 per cent.

ORANGEBURGH.—We knew nothing of hog cholera in this county previous to 1859. Do not know where it came from. Since it first made its appearance it can always be heard of in some part of the county. Previous to its appearance there was no disease among hogs, and great numbers were raised here. This industry is again on the increase. Ten years ago but very few hogs were raised in the county.

SUMTER.—We have no disease among either horses, mules, or cattle in this county. The few that have died are not worth mentioning, and have generally died from colic, occasioned by indiscret feeding. Our horses and mules are generally kept in well-ventilated stables, with plenty of pine-straw bedding. Our cattle are rarely ever stabled, and are comparatively very badly cared for. Hog cholera has been known in our county for a great number of years. It is said to have been unknown among our old-time "razor-backs;" is said to have originated with the introduction of the better breeds of hogs, but no doubt it is occasioned by the different treatment, as our hogs are now more confined than in former years. I lost last year in two days 60 head of full-blood Berkshire hogs. They were confined in a 5-acre pasture and fed on corn, ripe amber sugar-cane stalks and tops, and on acorns. I turned some forty head that were left into the river swamp to run at large, and did not lose another one.

WILLIAMSBURGH.—As my memory serves me, hog cholera first appeared in this county about the year 1857. Previous to that time the disease did not prevail. It is fearfully destructive when a herd is attacked, and the impression prevails that it is wise to give salt and soda, and sometimes turpentine or petroleum oil, as a preventive. The past year I thought at one time I had reliable symptoms of the disease among my hogs. I immediately began the free use of salt, soda, and kerosene oil. I lost no new cases, and the disease was arrested. Whether it was cholera or not I don't know.

TENNESSEE.

ANDERSON.—Hog cholera has probably existed in this county for thirty years. Each year sees more or less hogs die by this disease. I think that hogs die more from neglect than from cholera. I never lose any from this disease, and I endeavor to keep my hogs healthy by using preventives and proper precaution.

BEDFORD.—So-called hog cholera has been here longer than I have. Almost every man who has lost hogs by it has opinions and theories of his own, but none of them are of any scientific value. As to the time or means of its introduction, I can get no reliable information, but it is said that before its advent hogs here were healthy. Among the cattle or sheep I can hear of no prevalent disease except hollow belly, caused by the stinginess of their owners. I have heard of no disease among horses or mules worse than distemper, and that has not been very bad, rarely proving fatal.

BENTON.—Hog cholera made its first appearance in this county about the year 1858. Hogs were generally healthy up to that time. Since then the disease has visited our county every four or five years. It killed more hogs in 1886 than it ever did in any previous year. Hogs are very healthy this year.

BLOUNT.—Cholera prevailed among hogs in this county last year, and a great many animals died. It made its appearance in the county many years ago, but it is impossible to give the exact date.

CARTER.—Hog cholera is the greatest drawback that attends the raising of pork in this county. It made its appearance thirty to thirty-five years ago. In earlier days it killed almost all the hogs at once; at present it is a slow disease. Farmers have tried various remedies, all to no good. While some claim to have found a remedy, when tried a second time it failed to have any effect. We can not form any conclusion as to how the disease made its advent into this county.

CHESTER.—Hog cholera first made its appearance here in the spring and summer of 1859. Hogs were generally healthy before that time. How it was introduced I can not say. It made its appearance about the time people commenced to improve their stock of hogs by sending to Kentucky and other places for fine blooded stock. Hogs were taken with vomiting; some would not live more than twenty-four hours, while others would live two or three days. Hogs have been affected differently since, but the disease is all called cholera. Some two or three years ago they had some disease which killed nearly all that had it. They would be taken with a giddiness, and their eyes would break out in running sores, and all their hair would come off. We have not had any disease among hogs in the county this year that amounts to much.

CLAIBORNE.—Hog cholera was unknown in this county until about the close of the late civil war, when it made its appearance here; and it was then supposed by the inhabitants that it was caused by the hogs eating carcasses of dead horses and mules in the path of the army. It has never since been entirely out of the county, but some years it is more destructive than others. This year there is very little of the disease, but last year a majority of the hogs were lost from it. It is thought to be contagious, but at times it breaks out in an aggravated form on farms far removed from hogs suffering with it or that had any chance of contact with infected hogs. No certain remedy has been discovered for it. No condition of the hog seems to be a preventive. Almost every farmer in the county lost a greater or less number last year, but this year very little complaint is heard. It is the general idea of farmers that the mast has something to do with it; that is, the year following a heavy mast the cholera is more prevalent than when there is a failure. Yet before it made its appearance here we had more mast and no cholera.

COCKE.—Hogs in this county were remarkably free from cholera during 1887, and sold for better prices than usual. I can not ascertain when cholera first made its appearance here, but it has been very fatal, farmers often losing 100 to 150 head each. I mean our best farmers. During the past year the weather was dry, and not exceeding 250 head died of the disease.

DAVIDSON.—Prior to the appearance of hog cholera, years ago, hogs in this county were generally healthy.

DE KALB.—Hog cholera was but little known in this county prior to about 1865-'66. There may have been a few cases here before that time, but it was not known as a malignant or contagious disease. Its special characteristic is the poisoning and destruction of the blood in the animal. Especially is it destructive of the blood corpuscles. It destroys the secretive power of both the kidneys and liver also. Hogs were very healthy before its introduction; in fact, our hogs are scarcely ever troubled with any other disease now. I am unable to give the means of its introduction.

DICKSON.—What is known here as hog cholera first made its appearance in this county about the year 1866. Previous to that time hogs were generally healthy; no such thing as a fatal epidemic had ever attacked them. It is not known how the disease was introduced here. Every known remedy has been tried to check its ravages. It is thought that a decoction of Indigo water has proven more efficacious than any other tried remedy. For the last two years the disease has been very fatal. At least 50 per cent. of all the hogs in the county have died of it.

DYER.—This county has been comparatively clear of hog cholera this year, and hogs look well and seem to be unusually healthy at this time, as they have been during the year. Pork has been bringing a fair price and the interest in hogs seems to be increasing everywhere. Cholera generally attacks the hogs here in the summer.

FENTRESS.—Hog cholera has been in this county for forty years. Thousands of hogs have died from this fatal disease, and farmers have lost thousands of dollars thereby. The quinsy killed our hogs before the cholera made its appearance in the county. Horses are healthy. Cattle are generally very healthy; some few cases of bloody murrain, which have proved fatal. Some cases of rot among sheep, which have also proved fatal.

FRANKLIN.—The disease known as hog cholera has prevailed more or less in this county since its first settlement, although not called by that name here until within the last twenty years. After a careful investigation, with a view of ascertaining the cause of this disease, your correspondent is still at a loss to specify it with definite certainty, but I am satisfied of one material fact, viz., that hogs running at large in the mountain districts of this county during the season when mast, such as walnuts, beechnuts, and butternuts are abundant, are most frequently attacked with cholera, and they are more liable to die from its effects than those which are kept enclosed and are fed on a grass, slop, and grain diet. The losses from this disease are growing less as the practice of fencing in and feeding swine increases. This fact is perhaps suggestive and worthy of notice as a basis for further inquiry in the same direction. This present year has witnessed great improvement among farmers in the way of housing and in methods of feeding stock as recommended by leading stock breeders and growers, and there seems to be a general awakening among our producing classes as to the necessity of improving the quality of their stock by adopting the methods of our most advanced and successful stockmen.

GIBSON.—I have had some difficulty in obtaining correct information on all the points, and will give the answers of two assistants, who are old citizens with myself, in the county. One assistant does not answer at all, for want of information in his section. One writes that cholera made its appearance in the county about the year 1853. We have never found any remedy that did much good. Hogs were in a healthy condition up to the time that cholera made its appearance. They have never been so healthy since. In this section (eastern portion of the county) we have cholera more or less every year, though worse after a heavy mast. The other correspondent writes: I think it must have been some time in the forties that we first heard of hog cholera. Before that time everything was quinsy, as now everything a hog dies of is cholera. I have known or heard of but little complaint of hogs dying the past year, not over 10 per cent. My own observation has been that the introduction of cholera was due to the importation of blooded hogs, such as Berkshires, Chester Whites, Suffolk, etc., as it was among chickens with the importation of the Asiatic fowls. The date I would fix between the years 1848-'52 in this county for the first appearance of hog cholera. My own experience and observation have been that the hogs which are permitted to bed in straw and under shelter, under out-houses and the like, are more susceptible than if allowed to take the range. With proper attention and care, occasionally salting them, and when lice appear, as may be seen by the nits, a good greasing with hog's lard and coal-oil, not forgetting to keep them in a fattening or growing condition, no fears need to be apprehended of cholera. The best antidote I have found is to give them access to your orchard, and if not convenient, to gather up the fruit, peaches, apples, plums, etc., and feed to them instead of selling the fruit at 50 cents per bushel; it will pay better prices fed to the hogs. This has been my plan, and my hogs are noted for being exempt from cholera, while my neighbors' hogs are dying around me.

GILES.—The disease generally designated hog cholera was prevalent and is now prevailing in many sections of our county. The disease is fatal in nearly every case where the subject is sufficiently affected to have its appetite destroyed. The very few that recover are of but little or no value. The symptoms are a loss of appetite, hot, dry skin, red eyes, bowels generally constipated. The victim becomes dull, lying in bed most of the time, and dies in a short while, sometimes in twelve hours, but sometimes lingers for a week or even two weeks. The disease is both infectious and contagious. A place once infected remains so for several years unless efforts

are made to thoroughly disinfect the beds and other places where they lie. Turpentine and carbolic acid are used as preventives to some extent.

GREENE.—Hog cholera first appeared in this county in 1857. Hogs driven from Kentucky southward are supposed to have introduced it here. Many remedies have been tried but with varied and uncertain results. When the disease first appeared, a near neighbor's hogs became badly affected. Some died and many were sick. As a remedy he put about three quarts of hot ashes and live coals in a pail of buttermilk, which they drank greedily, and every sick hog got well. He occasionally gives his hogs the same throughout the year, and has never had a hog affected with cholera since. I once had over 20 thrifty shoats that, after 6 of them had died, at the rate of about one a day, I gave the remaining 16 chlorate of potash, and all got well immediately. It certainly was a remedy in this case, but with other lots attacked afterward it failed to cure. The same with calomel. It cured once, but failed afterwards. Previous to the appearance of cholera hogs were much more healthy than now, and had more careless attention formerly. Some ten or more years since I had some hogs to die, and in *post-mortem* examinations found all the lean meat filled with round specks resembling, in size and color, white mustard seed, and lying so loose in the flesh and so numerous that a half-teaspoonful could be scraped off a cut surface with a knife. Among a lot fattened the same year were three, apparently as fat and thrifty as any of the lot, but on opening them I found them similarly afflicted, but in a somewhat less degree. An article in an agricultural paper (Country Gentleman) calling for information and remedy relating to the disease was replied to by Levi Barttel, of New Hampshire, stating the disease was measles, and a sure remedy as well as preventive was to feed flower of sulphur to hogs, which I have done for now ten years, not only without having no other case, but with such an improved appearance of the meat on butchering that I have grave doubts about the perfect soundness of pork if the hog has not been fed sulphur. *

HANCOCK.—Hog cholera was not known in this county prior to the year 1861. The mode of its introduction is not known. The disease must have originated here, as no hogs were brought into the county from other counties. Hogs were generally healthy prior to the year above named, with the exception of a few cases of quinsy, which in some sections proved to be quite fatal. The disease was more fatal when it made its first appearance in this county than at the present time; 8 per cent. of the hog crop has been affected during the present year, of which 50 per cent. has proved fatal. Horses have been unusually healthy during the present year, as it will be noticed that hardly 5 per cent. have been affected with disease of any kind. Cattle have been healthy and in good condition all the year. There have been more cattle killed for beef than in any year previous since the organization of the county. Sheep have done as well this year as usual. Out of 9,021 sheep 270 have been affected by disease, which number is about 3 per cent. of all the sheep in the county; 16 per cent. of the affected have died. The average price of sheep in this county is \$1.25. They are all scrubs. The number of sheep destroyed by dogs is greater than the number which die from disease.

HARDIN.—Hog cholera made its appearance in this county last spring, and did considerable damage, so much, indeed, that our supply of meat this fall will be greatly diminished.

HARDEMAN.—There has been no cholera in the county this year so far as I have heard. Of course hogs die every year, more or less. They frequently die in the spring from eating cockle-burrs. Hogs are more healthy this year than usual. Horses are occasionally attacked by blind staggers, which is generally fatal.

HAWKINS.—Every epidemic among hogs that is very fatal is denominated hog cholera. In the year 1886 it was unusually prevalent and fatal, and had not entirely disappeared at the beginning of the year 1887. In 1886, in many parts of our county, the disease came very near making a clean sweep, many large farmers being left with less than a dozen hogs, all told, and many smaller ones without any. This year hogs have been very healthy, after the remnant of sick hogs at the beginning of the year died or recovered. This fall a lot of about 125 to 140, brought here from Kentucky to be fed, and another lot of about 400 brought with them and taken to Sullivan County, developed the disease soon after their arrival, and in the two lots something like 175 died. I am unable to state what proportion of those affected died. The disease, I learn, is still prevailing on the farms where these hogs were fed, and to some extent on farms in their vicinity. Many remedies were tried, but with very little success. The first hog cholera known in this county was introduced by a lot of about 200 hogs brought here from Hardin County, Ky., about the year 1854 or 1855, and has prevailed here at intervals ever since. It is said it usually prevailed after a good mast year. But the mast last year was very rich, while native hogs have been quite healthy this year. No epidemic has prevailed among horses. More or less distemper prevails every winter. Pink-eye and charbon are

almost unknown with us. Have occasionally heard of a case of pink-eye. Colic and botts kill a limited number—neglect more. Black leg is to some extent fatal every spring, but the number lost from this disease is not large. Our cattle are remarkably healthy. Snuffles, catarrh, or rot, as it is variously called, prevails to some extent among the remnant of sheep left in the county. Dogs and low prices have been more fatal than disease. The above losses are estimated to cover losses from all kinds of sickness. Our county is free from disease in all stock except pigs.

HAYWOOD.—Hog cholera made its appearance about the year 1853, but not until the improved breeds were introduced. Now everything that kills a hog is called cholera. Cotton seed is the most fruitful source of disease among our hogs. A heavy mast or acorn crop produces constipation, which, if not attended to in time, will prove as fatal as cholera, and consequently is called by that name. All animals the past year have been freer from disease than for many years.

HICKMAN.—Hog cholera was first introduced here in the year 1870. Hogs were healthy prior to that time. It was introduced by speculators bringing hogs from a distance to feed and fatten. We have the disease with us now nearly all the time.

HOUSTON.—Hog cholera is one of the most fatal diseases that has ever visited our county. It made its appearance here in 1862, and has been very destructive ever since. Sometimes it will attack a herd and not leave one to tell the tale. In other instances it may kill a few while others partially recover, but never become thrifty again, or make good pork. I do not think the disease is so fatal as at first. Whether it has lost any of its force in its long course of destruction, or whether it is being better understood and remedies discovered and applied I can not say. Before the appearance of cholera in our county hogs were very healthy. They ran at large in droves and fed upon the mast of the woods and required but very little attention. As to the mode of its introduction, I will say that I believe that it was brought here with the improved breeds of hogs from the North and East. This is only a conjecture of mine, but I believe it is reasonable.

HUMPHREYS.—Hog cholera has been general and fatal in this county this year. About one-half of the crop has been lost by the disease.

JOHNSON.—As to the origin of hog cholera or its cause, it is very hard to determine. It has occurred in this county at intervals for a number of years. It does not appear every year; some years it is very fatal. Last year (1886) about 75 per cent. of the hogs in the county died with this disease, while during the present year it has not occurred unless in a very few isolated cases. During the year following a general or good mast season of acorns, chestnuts, etc., cholera is apt to occur, and a great many of the hogs die with it. Apparently it is spontaneous in some parts of the county, and spreads as an epidemic until it appears all over the county. Various remedies have been tried, but none appear to be a sure cure or a preventive. I think there is more to be gained by using preventives and putting the hogs in good healthy condition previous to the time for the appearance of the disease than by using remedies after its appearance. It appears to be more fatal in hogs in poor condition than those in good condition. It appears to be more fatal in hogs that are kept on dirt floors than those that are kept in floored pens. At least this is the case in my county.

LAWRENCE.—The disease of hog cholera has only prevailed on the creeks, and principally in localities where there are ponds of standing waters, left in the bottoms after the spring rains are over and the waters confined to their usual channels. No case of this disease is reported from the high and barren lands, in localities where the only water is freestone spring water. These localities have no ponds, and the only water is from springs. There have been various remedies used by the farmers on the creeks to arrest this disease, but all have failed. A change of locality seems to have the best effect to arrest the malady. Farmers send their hogs to the highlands, and such as have not been attacked before removal generally escape the disease. If confined in inclosures the hogs are turned out and sent to some other locality. There are several farmers engaged in hog-raising who use preventives, but in some instances their hogs have not escaped when the disease was in the neighborhood. The preventive used is tar, both in their food and water, also rubbed on the animal freely. As to the causes producing the disease there are various theories advanced. The disease among horses has been principally blind staggers, all proving fatal. Among young horses ordinary distemper has prevailed of more than ordinary fatality, especially during the summer months. Several stock-raisers lost heavily from this disease. A disease known among farmers as "dry murrain," has been very fatal to cattle. No case reported yielded to the usual remedies, but all proved fatal in from five to ten days from the time of the attack. Some diseases among sheep, but the principal loss has been from dogs.

LAUDERDALE.—Hog cholera first appeared in this county in the year 1857. Before that time hogs were generally healthy. It prevailed generally over the county that

year, nearly simultaneously breaking out in herds that had not been mixed with those affected. It seems to be rather epidemic than contagious. Some are inclined to the opinion that the disease was brought in by importing Berkshires and other improved stock. It is believed by others that it is produced by feeding rich, stimulating, dry food. It is generally more prevalent during good mast years, when the tannic acid in the acorns may constipate the lower bowels and thus get up inflammation of the stomach. But we know but little about it.

LINCOLN.—The disease known as hog cholera first appeared in this county about the year 1859 or 1860, and was very fatal, very few recovering. From that time to the present it has never been eradicated. For several years there were very slight losses, but in this (1887) it has been very fatal. The old gravel-rooter suffered as much as any other breed. I can not learn how it was introduced. Hogs previous to that time were very healthy. The lung fever or murrain prevails among cattle; losses sometimes heavy. It is believed to be spread by cattle from the South. Horses and mules healthy—no contagious disease for years.

MACON.—Hog cholera made its first appearance in this county about thirty years ago. Hogs were healthy previous to that time. As to how the disease was introduced into the county is unknown. The disease has generally prevailed more especially after a crop of oak mast, but it prevails also very bad in localities where no mast exists. Some years, upon examination of the intestines of hogs which died with so-called cholera, they were found to be full of small, white worms, to the amount of thousands.

MCMINN.—As near as I can learn the first case of cholera appeared among hogs in this county about 1858. Previous to that time they were healthy.

MENARY.—From the best information I can gather the appearance of hog cholera in this county dates back to about the year 1856; I do not know how it was introduced; I think hogs were pretty generally healthy before that time.

MADISON.—We have had no real hog cholera in this county for some time past. When hogs die it is generally said they die of cholera, but if examined closely it will be found that they are infested with lice. People take so little care of their hogs that they let them get mangy, when they die and they say they die of cholera.

MARION.—The year 1847 is about the first I remember of what is called hog cholera. My opinion is that the disease or trouble with hogs is occasioned by a living germ or parasite. I never knew hogs to be sick with this complaint that were not covered with lice. But few get well. Preventive remedies are the best; sulphur, copperas, salt, and unleached ashes mixed and kept where the hogs have free access is about the best remedy we have. The condition of the live-stock in our county is good. Some cholera exists among hogs.

MARSHALL.—The disease that is usually called hog cholera made its first appearance in this section in 1865. In 1862 a contagious disease had destroyed large numbers of hogs. It was called cholera, but incorrectly. It was really quinsy, an affection of the throat and bronchial organs, and was in its nature and effect very similar to diphtheria in the human being. There was neither vomiting nor purging, one or both of which is sure to result from genuine hog cholera. Since then every time a man loses a lot of hogs, even though they may have died from lice, lying in old straw-piles—where clover hay has been thrashed for seed, in old dusty stables or other dusty beds, etc., or from kidney disease, or even from starvation, the hog cholera is credited with having killed them. As to whence it came, or the means of its introduction, I am unable to inform you. Prior to the quinsy epidemic of 1862 hogs were generally very healthy here.

MORGAN.—Hog cholera made its appearance in this county about the year 1858, in a very virulent form. Since that it has been raging every year. It seems more destructive every succeeding year, and is generally worse after a mast year. No remedy has been found for the disease.

MONTGOMERY.—How long hog cholera has been with us I can not now recollect. I distinctly remember its first appearance here. It was more fatal then than now; it left but few hogs in the flock. It cleaned me out, I know. I can not give dates, but I feel sure it was in the forties—perhaps between 1845 and 1850. I never knew of hogs having any disease before the cholera struck them. How it got among our hogs I never knew; it appeared to strike them like Asiatic cholera strikes man. We know of no remedy for it.

MOORE.—The exact time when hog cholera made its appearance in this county I do not remember. I think it was in the year 1866. I find that the hogs die in greater numbers at distilleries than on farms. I have a neighbor who pays much attention to his hogs. He gives them every week what lye soap-suds they can drink. He is careful to save all the suds on washing days for his hogs. He says since he has adopted this rule he has not had a case of hog cholera. He commenced this about ten years ago. The disease prevails here every year. Our county has suf-

ered more this year (1887) than ever before; some farmers have lost every hog they had. Before the cholera made its appearance in this county hogs were very healthy. It was a rare thing for hogs to die after they had been put up to fatten.

PICKETT.—Hog cholera first made its appearance in this county (then Overton and Fentress Counties) as far back as 1851 or 1858. The mode of its introduction is unknown. The disease operated differently then. The hog frequently would die in a few hours, purging and vomiting during the time of illness.

ROANE.—Hogs have died all over the county by the wholesale the past summer and fall, and are still dying in some sections. Fully 90 per cent. have died with this disease of cholera. It is a different form of cholera from any we have ever had before. Some die in an hour or two; hardly any live longer than forty-eight hours after first symptoms are discovered. They begin with a cough, and when they have an action it is very watery and black. Everything fails to effect a cure.

SCOTT.—No hog cholera prevailed in this county the past year. It made its first appearance here about thirty years ago. Do not know the means or mode of its introduction. It has reappeared about every third or fourth year since. No contagious disease prevailed among any other class of stock during the year.

SEVIER.—I have failed to find out when hog cholera first made its appearance in this county. But it was some time prior to the late unpleasantness, probably between 1850 and 1859. There have been heavy losses among hogs the past year.

SEQUATCHIE.—Hog cholera was first noticed in this county about 1850. The cause of its introduction is probably not known, but my experience is, the principal cause is lice. They become so numerous as to penetrate the ears, and perhaps burrow their way into the head. They take it, or rather manifest it in different ways. Some get lame in one foot, and in a few days all their feet seem affected as if they were sore, stepping the hind feet well under the body nearly up to the fore feet. They are disposed to lie a great deal of their time, and when forced to move they seem frightened, running off a few steps and then resuming their former positions. The most common symptom is a coarse, whoopy cough, followed by loss of appetite and an aversion to food; and if they recover at all it usually leaves them with a rough, crackly skin, becoming perfectly nude, and when the hair returns they are invariably gray. Coal-oil poured on them and sulphur administered inwardly usually kills the lice and gives relief. Linseed-oil given when the cough first appears is a good remedy. I have noticed that plenty of buttermilk often affords relief. Horses are remarkably healthy and disease is very rare. Cattle generally healthy, but a few deaths from murrain; quite a number die annually from what is known here as milk-sickness, a peculiar poison supposed to be the effects of some mineral, either accumulating in the water they drink, or from evaporation settling on the vegetation they eat. It affects no other animal known but cattle. It proves fatal to persons eating the milk of the cow unless active remedies are used. Dogs eating the carcass of such as die almost invariably die.

SHELBY.—I copy from one of my valued correspondents, a physician and a farmer, as follows: "Hog cholera made its appearance in this county in 1847, and has occurred at intervals ever since. So far all remedies have failed. No specific has been found. We have had a plague among swine for several years. I have investigated it professionally and have concluded it to be different from so-called hog cholera. I call it "gnat poison." It begins shortly after the Buffalo gnats make their appearance, and is a skin disease. It is extremely fatal. Hog cholera was introduced by hogs brought from the North. Shortly after importation they died as hundreds of others died the same year." As to cholera being introduced by Northern hogs brought here is, I think, doubtful.

SMITH.—Hog cholera first appeared in this county about the year 1860. I never saw a case until 1860. It did not become general, however, till 1862—during the late war. There is a prevailing opinion that its advent, in point of time, corresponds with the introduction of the imported breeds, Berkshires, Irish Grazers, etc., to cross upon what was then our native stock. Indeed many believe that, as a rule, it is now confined to mongrels, pure blood of any stock being free from it. While not concurring in this opinion, I think observation authorizes the belief that cross-breeds are more liable to it than pure-bloods. The general condition of stock has been good all the year, and, except hogs, they have been healthy. Nearly all young horses and mules have the catarrhal affection known as distemper, but this rarely ever proves fatal. The most of those that die die of colic, the result of overwork or imprudent feeding, or of old age.

STEWART.—The first cases of hog cholera that I can get an account of occurred in 1862. It has prevailed first in one locality and then in another since that time. This year there has been less of the disease than usual, and stock hogs are in good condition. In many cases the animals would be taken in the morning and die before night. No vomiting or purging. The hair would appear ruffled, the nose would

rest on the ground, and in a few hours they would lie down and die. None got well hat were attacked; but about half would escape. None of the fattening hogs died.

SULLIVAN.—Hog cholera made its first appearance in this county in the year of 1862. It was very fatal that year. That year the writer had 42 head and lost all but 6. They were very fine, the largest weighing 300 or 400 pounds. I don't know how it was introduced. From that time down to the present it has kept the number of hogs limited. Sometimes there would be a period of from one to three years that hogs would be healthy and do well, but then would come a fresh outbreak and nearly exterminate the crop in the county. No specific as yet found. All are attacked, those in pens and those isolated as well as those running at large. Some farmer every now and then will proclaim that he has found a cure, but upon trial is doomed to disappointment.

SUMNER.—Hog cholera made its appearance here about thirty years ago, but as to the mode of its introduction I can not now state. Previous to the introduction of the disease farmers very seldom lost hogs to amount to anything. It seems there is no cure for the disease; after taking it only those that would naturally get well recover. I lost a great many hogs from the disease previous to 1866, but since that time I have lost but very few. I buy the crude petroleum by the barrel and use it once or twice a week on the hogs, and give it to them on corn occasionally, and since doing so have not lost a hog from the cholera. I am thoroughly satisfied it is a preventive, but not a cure. Of course it is necessary not to let hogs use the same bedding for months at a time, without a cleaning up.

TIPTON.—Previous to the close of the war we heard of no epidemic or wide-spread fatality among hogs. They were healthy, thrifty, and on many small farms increased so rapidly that pigs and shoats were offered for sale in the spring and summer at very low rates. No clover was then raised and the summer keep of hogs was the most troublesome period in their culture. The mast was our unfailing dependence to make our meat, allowing from three to five weeks of corn feeding before killing. Every small and moderate farmer made his own meat and lard in abundance, and often to spare, which was taken by the large negro plantations or quarters. In 1865 there was a visitation of fatal disease among the fed swine, which was called cholera, a name derived from our northwestern friends in Ohio, Illinois, Indiana, and Kentucky. Owing to the ravages of war and the loss of all farm animals there was a great scarcity of hogs, and generally what few were left to the family were penned near the house both for protection and for slopping and kitchen feeding, as there was scarcity of corn everywhere. There was a fearful visitation of the Buffalo gnats that spring, in April. In the early summer of 1875 there was a mild visitation of cholera and also preceding this the buffalo gnat, which drove our teams from the fields. In 1884 the most fatal and universal epidemic of hog cholera occurred, which almost destroyed the stock of hogs with us. This followed quickly a severe and prolonged visitation of the gnats. Before our stock had been restored and built up from this, again the cholera (very fatal) visited us and reduced our stock to a minimum, so that no farmer made his own meat last fall (1886). The inevitable gnat came on us in March, 1886, in dense swarms, lasting for four weeks. Three days after I noticed the gnats my hogs began dying. These may be coincidences, but I am firmly persuaded that cholera depends on the poison infused into the system by the bite of the buffalo gnat—I mean the fatal epidemic disease that has carried off our hogs for the past twelve or fifteen years. Of course I am aware that hogs have died in enormous quantities when the gnat never appeared. I confine my remarks to what has occurred under my own observation. During the past year the health of all farm animals has been unusually good, so that the losses from ordinary causes have been less perhaps than an average. All farm stock has increased notably in the past six or eight years. A majority of farmers are breeding good mares to jacks, and are all raising mules for their own needs and often to sell. So of horses. Cattle command a good price and much more care is bestowed on their culture. The poor white and negro tenant can hardly be persuaded to try to raise their own plow mule and milk cow, and to this extent are a drawback on stock increase in our county.

WARREN.—Hog cholera manifested itself in this county between 1850 and 1855. Up to that time hogs were very healthy. In 1841 I fed 300 head in one lot, with the loss of one single hog. Since then I have lost 40 to 50 out of a herd of 100 head. In 1885 we lost all but 15 head. No remedies seemed to do any good. It has visited my farm at periods of from seven to fourteen years. Our hogs are very healthy and prolific when free from this disease. The hog is the most profitable animal we can raise when unaffected by disease.

UNION.—Hog cholera made its appearance in this county about the year 1856. No remedy for the disease has ever been discovered. Its visits are periodical—usually from two to three years—and it is very destructive.

WASHINGTON.—Hog cholera first made its appearance in this county about twenty-six years ago, or in the year 1862 or 1863. I do not know how it originated or was brought into the county—some say by importing hogs from other States. I have noticed that we have cholera the summer following a heavy mast year, almost invariably. Hogs were generally healthy prior to the year 1863. Most people call every fatal hog disease cholera.

WAYNE.—Hog cholera made its appearance in this county about July, 1857. My father owned 200 head of hogs at that time. They were very healthy previous to that date. He lost 130 of this number. Cholera has been in my county, in some parts, about once every two years since. There has been none this year that I can hear of. The best remedy that we can use for cholera is strong wood ashes and salt, given at least once a week in spring and summer. It is sometimes necessary to be given in the fall and winter.

WILSON.—I am of the opinion that hog cholera prevailed here forty years ago, though not nearly so violent or fatal as in later years; at any rate we had it before the war. Our people had the cholera in 1833, and I do not think it was many years afterwards before the hogs had it; but we have no statistics by which we can arrive at anything like accuracy. The disease is not so general now as formerly. We seldom hear of it now, and when we do it is confined to small circles of the country. Other kinds of live-stock have been remarkably healthy. Horses have distemper, which usually follows cold wet spells of winter weather, and I suppose is caused by short rations and exposure. Pink-eye has been troublesome, and has caused some blindness.

WILLIAMSON.—Hog cholera, or what is understood to be that complaint, prevailed in this and adjoining counties previous to 1858. I have always been under the impression that the disease was produced by bad treatment and the lack of proper attention. My manager on my farm advised me, as far back as 1858, that the disease was more easily prevented than cured, and told me that if I would furnish him with lye soap he would keep out the disease. I had a fine herd at that time and lost no time in furnishing the soap. He immediately fed it to the hogs, and the next day took me out to show me the immense number of pin-worms voided by them. I have fed soap to the hogs frequently since, and have escaped the complaint until this year, and from neglect and lack of proper attention I have lost most of my herd. Fully one-third of the number of hogs of the county, according to my observation and information, have died of cholera during the summer and fall. Now all are healthy. I found in that portion of the county where there is freestone water no hogs were reported sick. The limestone part was badly scourged. Horses were usually healthy. Cattle were afflicted with a new disease called pink-eye; but four deaths resulted from it.

TEXAS.

ANGELINA.—The understanding in this county of hog cholera is that none but hogs in good condition are subject to it. But during the last epidemic we had among hogs, some two or three years ago, all died, both fat and poor. Some said the disease was cholera and others said it was not. No one who was qualified to examine or diagnose the disease did so, and we still do not know what it was. I believe nine-tenths of the hogs in the county died. Since then no disease has appeared among them, and we have now an abundance. This year mast is good, and we will have an abundance of meat. No one in this county fattens meat. If the mast is good hogs get fat on that and we have plenty of pork.

ARCHER.—Hogs in this county run on the range and are very healthy. Last winter we had some losses from want of mast. No hog cholera in the county.

AUSTIN.—Hog cholera, or a disease closely resembling it in its fatality, has prevailed at irregular periods since 1853. That year vast numbers died, in some instances entire herds were swept away. Various remedies have been tried without success. As to how and where it made its first appearance it would be impossible to tell. It has been as fatal on isolated farms as it has in thickly settled communities. Two farmers, who lived several miles from their nearest neighbors, lost all of their hogs but a few young ones. We in old times called it choking quinsy, afterwards cholera.

BANDERA.—Hog cholera is a disease unheard of in this county. Neither horses, cattle, nor sheep are often attacked by disease in this county.

BAYLOR.—Hog cholera is unknown in this county. We raise but few hogs, and they are confined in pens. Texas or Southern fever is occasionally communicated to our cattle by animals brought from the southern part of the State.

BEE.—There has never been enough of hog cholera here for one to give any statistics about it. But few cattle die of disease. Some winters large numbers die of starvation.

CALHOUN.—There is no disease among stock in this county. Hogs are merely raised for home use. No range for hogs in this locality.

CAMERON.—Hog cholera is unknown in this county. There are but few hogs raised here.

CHAMBERS.—No hog cholera ever existed in this county within my knowledge. A disease attended with symptoms of measles has been in the county about eight years, which kills about 10 per cent. of the hogs annually. Farm animals, with very few exceptions, have no feed or shelter. Horses and cattle have been generally healthy during the year, with the exception of charbon.

COMAL.—No contagious disease prevails among our cattle, horses, sheep, or swine. The disease known as hog cholera is not known here. We raise hogs only for domestic use.

COLEMAN.—Genuine hog cholera, so far as our knowledge extends, has as yet never visited our county. A great many hogs have been lost by our farmers in past years during winters, but it has been through poverty, when there was not a sufficient amount of mast for them to subsist upon. Outside of this our hogs have always been very healthy. I would remark that lately there have been hogs of fine breeds imported into our county. As they are kept up and not allowed to run loose on the range it is possible that it will not be long before hog cholera will visit our section, as it has in other counties of our State. All kinds of stock are generally on the decrease in our county. One cause is that farmers are paying more attention to farming; another cause is that the county is being fenced up by those able to fence, and our poor farmers have either had to dispose of their stock or drive to sections where there is still loose lands. Horses, cattle, and hogs, so far as known, are in good health and condition. Sheep are badly affected with scab. It is feared that a great many will be lost if we should have severe weather. Some of the flock-masters are now dipping their sheep, doing it much earlier than ever before.

COLORADO.—I have been living in this county ten years, and I do not now recall a single case of what is known as hog cholera.

DUVAL.—There are but few hogs raised in this county, and no disease has been known among them up to the present time. Sheep are subject to *lombritz*, and often the losses are quite heavy.

FALLS.—Horses, cattle, sheep, and hogs have all been remarkably healthy the present year. Some few head of cattle, and also some horses, have died, yet not many more than usual; such deaths are attributable to age and scarcity of grass on our prairies, which was cut short by our long drought. Our law is such that all hogs have to be inclosed in pastures or lots, and many farmers have concluded it to be cheaper to buy Northern pork and bacon than to raise hogs. Nothing like cholera in what few hogs we have has made its appearance the present year.

FREESTONE.—The disease among hogs has never, so far as I can learn, been thoroughly investigated. Some hogs that die seem to be affected with the cholera, while others often are destroyed from other causes, such as the eating of cotton seed, etc. I do not think the disease proper has been made out, although whenever a hog dies it is generally attributed to cholera.

FRIO.—No such disease as hog cholera prevails in this county.

FISHER.—All animals are universally healthy—have not heard of any disease among horses, cattle, sheep, or swine, except the disease called scab, which is very common among sheep. It was brought in from south and southwest Texas and Mexico. This is gotten rid of in a year or two by dipping and frequent change of range. There never has been any hog cholera here.

GRIMES.—Have heard of no epidemic disease among domestic animals except among hogs. Please bear in mind that perhaps 90 per cent. of all the hogs raised in this county are raised upon the range, as it is called, except, perhaps, when a farmer "puts up" and feeds only for the use of his own family. This may be said to be the universal practice. As to the time of the introduction of hog cholera into the county, I have not been able to get any reliable data. It is an assured fact, however, that prior to the coming in of that disease hogs were healthy. It seems that hogs on the range are equally liable to the attack of the disease with those that may have been raised inside on inclosures. No remedy, so far as I have learned, either curative or preventive, has as yet been successful.

HARDEMAN.—Have heard of no cases of hog cholera this year; in fact we have had nothing of the kind since our county was first settled. Cattle have been healthy with the exception of a few that were driven into the county during the summer. Scab is the only disease that has prevailed among sheep.

HASKELL.—There is no hog cholera in this county. We have but a small number of hogs here, and they are healthy.

HAYS.—There are but few hogs raised in this county, and I have never known of any loss from hog cholera.

HENDERSON.—Hog cholera, from the best information that I can get, made its first appearance in 1874. Anterior to that time this county was noted for its vast and cheap hog production, most seldom failing; the meat was made entirely in the woods, costing nothing but the labor of killing and cleaning. A dead hog before that time was a rare occurrence, but now hogs are very scarce, and the people are slow to attempt raising them. One reason is, that the range hogs' time is nearly ended, and another is that the cholera or something else is so sure to visit us that it keeps people from trying the hog industry. Of the cause of its introduction we know but little. Some wiseacre attributes it to the introduction of the blooded hogs.

HILL.—We have no hog cholera. Hogs are remarkably healthy. During my residence here of eighteen years I have never witnessed anything like cholera, except two years ago, at a beef pen near here. The hogs (which were driven in from the West to fatten with cattle) were affected with something like cholera, but it did not spread from that herd and disappeared with it. About 50 per cent. of them died; the remaining ones got well and fattened. There were about 250 of them. Hogs or pigs sometimes die from eating cotton seed and also from eating cockle burrs. The only disease among horses is what some term "Mexican glanders," but it is very rare. It is more fatal to mules than to horses. I have not known a case the past year. Cattle and hogs are free from disease. Sheep are subject to scab when neglected.

HOPKINS.—I can obtain no information whatever as to the date of the introduction of hog cholera into this county, or the means of its introduction. One of my assistants, a native, says he knows nothing about it. He says: "It is a prevailing opinion, when any disease gets among our hogs and decimates them, that it is hog cholera, and well enough, I reckon, for they die all the same." I have seen great numbers of hogs that were said to have died of cholera. I knew they starved to death. I have known many hogs in good order to die; they had plenty of acorns but no water. A neighbor turned a large number of fine hogs into a pea field and left them there. They all died; he said they died of cholera. Many have died in the fattening pens when nearly ready to kill—fed exclusively on corn. I have never lost a hog by cholera or any other disease. I give a little salt, some sulphur, burnt bones, and plenty of charcoal; feed weeds, vegetables, slops, oats, and corn. Still there is sometimes an epidemic among the hogs, because in a neighborhood nearly all the hogs will die, no matter how they are cared for. The rule here is, no feed most of the time, and all corn when they do feed. I estimate that 1 per cent. of cattle die of disease, generally dry murrain, caused by want of water in summer when the feed is dry. There are no prevailing diseases among cattle. As I formerly reported to the Department, 95 per cent. of the cattle that die die of starvation. Hundreds of them are getting ready to die now—just waiting for the "heel-fly." Sheep are but little affected by any disease except scab, of which but few die. Neglect is what gets away with most of them. Last August and September I estimated that 1,000 head of sheep died of some unknown disease. I attributed it to drinking filthy water, the wash of the range collected in pools in the creeks. The blood of all I examined was thick and black. Before death there was no indication of disease. Nearly all died during the night.

HOOD.—Hog cholera has an unlimited class of symptoms. Every dead hog found is said to have died with cholera. I came here in 1869 and heard of cholera then. Empty cribs caused a majority of the deaths in the hog family. Some few fat meat hogs have died with cholera recently. We know no cause, neither can the oldest settler tell me when the disease first made its appearance. The Indians who raided through this county in 1869 spoke of a disease resembling cholera many years previous. Filth and poverty are the causes in most cases of cholera. A few cases of staggers among horses are reported. Profuse bleeding in neck relieved most of them. That has proven an unfailing remedy so far as I have tried or heard of its being tried. A small proportion of young cattle are always affected in the early spring with what we call black leg, unless wood ashes are freely used when salting. That will prevent it. Some herds of sheep have been badly affected with scab, caused by neglect.

HOUSTON.—The first appearance of hog cholera that I remember was in the winter of 1862-'63, and was more fatal than it has ever been since, unless this year has the precedence. As near as I can estimate, about two-thirds of the hogs that were in the county January 1, 1887, have died from the disease called cholera. I am satisfied that parasites have a great deal to do with the disease of hogs, such as kidney worms and worms in the bowels. Hogs die very often here from lung disease, similar to pneumonia in people, which is mostly caused by them sleeping under houses where there is much dust, which the hog takes into his lungs in breathing.

JASPER.—Hog cholera appeared in our county last summer a year ago, and in the summer of 1886 destroyed nearly all the hogs in the county; we lost at least 85 per

cent. The hogs were in good condition. The weather was dry and dusty. Since then we have had no more of it. Nothing was done to cure or prevent. Frequently all the animals would die out of a bunch of 10 or 15 head. Sometimes 1 or 2 would be left. They would all appear well, then for no apparent cause one would lie down and die, and so on all summer.

JOHNSON.—Hog cholera appeared here some twenty years ago; has prevailed to a limited extent ever since, but it has never been general. I have heard very little complaint for several years past. It is considered contagious.

KARNES.—We have no hog cholera in our county. All classes of farm animals are in good health. We have had an abundance of grass for pasture.

KAUFMAN.—Having been well acquainted with swine plague or hog cholera, both in Illinois and other States east of it, I can truthfully say I have never seen in Texas what I would call a genuine case of the disease. It is true some hogs die here, but upon close investigation we find they have had a chance at cotton seed, or cockle burrs in the spring, which results in death unless they are fed corn or other grain to counteract the effects of the poison taken into the system, and that feed will generally do it. There was talk here of hog cholera about 1870, when people commenced importing to improve the breed, but since the importations have become acclimated. There can now be found as healthy Berkshires and Poland Chinas as razor-backs, and besides they pay a great deal better for their keep. As to diseases of cattle, we have a little black quarter or murrain, which invariably attacks animals in good condition.

KENDALL.—So far the hog cholera has never made its appearance in this county.

LAMAR.—If my memory serves me correctly we had no hog cholera here prior to the war of the rebellion. I think some eighteen or twenty years ago it first made its appearance. I know nothing of its origin. I am firmly of the opinion that we have never had one-tenth the cases in this county of hog cholera that was so reported. As you may remember some time ago I stated that, in my opinion, nearly all cases of reported hog cholera was not cholera, but that many deaths were caused by eating dry cotton seed. Every year I am more fully convinced that this is true. Out in our prairie precincts we have what is known as a hog law, that is, hogs are not allowed to run at large, and I notice all hogs that are kept in clean inclosures, or where they can not get to cotton seed, do not die with so-called hog cholera, but in other sections or timbered sections of the county they have no hog law, consequently their hogs are allowed to run out, and they get into gin lots, cow lots, etc., and eat cotton seed and suddenly die; then it is often said they die of cholera. I have stated this theory to our people often, and a good many of our best farmers fully agree with me. So far as I can learn hogs are perfectly healthy out in our hog districts now, and have been ever since we have been forced to keep them up while they could not get cotton seed to eat. I know before this law went into effect the hogs died as frequently out here in the prairie precincts as in the timbered ones. I lost as many as 82 head one year out of a lot of 120, and I believe every one died by eating cotton seed when they were dry. If seeds are boiled or watered well they do no injury to hogs, but in their dry condition they are "dead shots."

LAVACA.—This disease of hog cholera has not been reported in this county for years. It was not known here until the improved breeds were introduced from the Western States, about fifteen years ago. No other disease affected hogs to any extent before or since that time. The only disease prevailing among any class of farm animals is scab among sheep.

LEE.—A few years ago we lost a good many hogs, and it was supposed by some that they died of cholera, but our judgment is that they died from eating cotton seed. There was a heavy cotton crop made that year and cotton seed were in great abundance, and they were fed in all imaginable ways to cattle, and of course the hogs got a goodly share. It is known by all farmers in the cotton belt that cotton seed will kill hogs, and the symptoms are those of cholera. Fully 95 per cent. of the hogs that are kept in close pens are butchered. Cattle suffered greatly for want of water during the late protracted drought.

MCCULLOCH.—No hog cholera in this county. It may seem remarkable, but it is a fact that no disease prevailed among stock of any kind in this county at any time during the year 1887. All deaths were caused by accident or from neglect or improper use.

MCMULLEN.—Though but few hogs are raised in the county, they are remarkably healthy. Hog cholera is unknown in the county. This branch of the live-stock industry, when we consider the great natural adaptability of the country for the production of swine, has been unreasonably neglected. Hogs are kept in good flesh both summer and winter upon the range without feed. During August and September they fatten readily upon the fruit of the cactus (prickly pear), and I find by experience with a few head that they will keep in moderate flesh if fed alone upon

the stems and leaf of the same plant, and if in addition a small ration of grain be given very cheap pork might be produced.

MADISON.—Can give nothing authentic as to the appearance of hog cholera in this county. Hogs die through all seasons of the year. The symptoms are widely different, but every case is pronounced cholera.

MARION.—From the best information I can get in regard to the disease known as hog cholera, it made its appearance during or about the close of the late war. Previous to that time no disease prevailed among hogs. I have not heard of any cases of cholera during the year. In December a disease prevailed among hogs which seemed to be lung trouble, causing considerable loss. Those affected would begin to wheeze and cough, refuse to eat, fall off in flesh, and in three or four days die. Some, however, would linger twenty days, and occasionally one would recover.

MASON.—All classes of farm animals were exempt from serious disease during the past year.

MATAGORDA.—There are not many hogs raised in the county, and no hog cholera has ever prevailed here.

MILAM.—Hogs here are subject to cholera, but I have not heard of any dying within the last twelve months. There is no known contagious disease among cattle. A disease similar to farcy has prevailed among mules, and a good many valuable animals have died of it during the last two or three years. It does not seem to be contagious.

MONTGOMERY.—The first appearance of hog cholera in our county was in the year 1860. The means or mode of its introduction we do not know. Hogs were healthy up to that time. It is only occasionally that we are troubled with the disease. Our hogs are generally very healthy. We find that hogs running at large on the range are not as subject to the disease as those confined; in fact, it is a rare case to find cholera among range hogs. Occasionally, however, it makes its appearance among hogs confined, and many die, though such cases are very rare.

MORRIS.—Hog cholera made its appearance in 1865 in a mild form at times, killing only a few animals up to 1885, when it swept the county of nearly all our hogs. The first appearance of sickness was discovered by finding the hogs lying in bed late of a morning. They would remain in that way for several hours refusing to eat. It is thought by some that bitter mast will give disease to hogs; others think that cotton seeds kill more hogs than anything else. At this time hogs are in good health. Horses, mules, and sheep are free from contagious diseases.

NACOGDOCHES.—Hog cholera was in this county for a number of years before the war. Many die without any remedy being used, while some farmers try everything they can hear of. My remedy is lye, soap, and lime with meal and bran mixed. Have known them to be down with the disease; if they could be induced to eat this mixture they would get well.

NEWTON.—Hog cholera has been in our county about three years. At first it was confined to the swampy localities; then after the first year it spread over the hills. It appeared first in 1884-'85, and killed over half the hogs; in 1887 it destroyed about one-third, and this year only a few in early spring. Previous to the appearance of cholera we had some sickness among hogs every year in the early summer season. It was called rust on red legs. We at first thought it was cholera caused by muddy land after an overflow; but that idea was soon abandoned. As to a remedy, we have not found anything reliable. Charcoal has been used to advantage as a preventive. Mercury cured a few sick ones, but salivation, it was thought, caused the cure. We could raise large numbers here if the disease could be managed. For the past three years interest has been generally lost in their production.

PALO PINTO.—Mr. P. H. Price, who has been in this county from the beginning and engaged in farming and stock-raising, says: "The hog cholera was brought to this county from Parker County (adjoining Palo Pinto on the east) in 1877. Previous to that time no contagious or general disease had been known among hogs in the county. It has appeared some three or four times since. The only other disease of special note was called the hog measles, which appeared some five or six years since, and for one season did much damage." I am not aware that any disease has prevailed among hogs, horses, cattle, or sheep during the past year (1887).

RAINS.—Hog cholera first made its appearance in this county in the year 1876. In the winter or spring following fat hogs died in great numbers on the range after getting fat on the red-oak acorns. It has visited us every winter and spring since that date when we have had mast sufficient to make them fat. The mast gives out in winter when the weather is very wet and cold. As to the true cause of the disease we can not say. Cattle are perfectly healthy, but die for want of feed and shelter. Sheep have the scab when not properly attended to. Sheep-owners who dip their sheep in carbolic preparations do well here. Hogs have the cholera generally after good crops of mast. Horses are generally healthy, except the diseases common to work stock.

REFUGIO.—Hog cholera first appeared in this county in 1878-'79; since then there has been no disease. Hog-raising receives no attention in this county. Our supply of hog meat comes from the North. Cattle-raising is the chief object. Every year there is probably a loss of about 8 per cent. of hogs that die from the effects of eating the young and tender leaves of the cockle burr.

ROBERTSON.—I very much doubt if genuine hog cholera ever originated in the hogs that are allowed to run at large. Many of them die, some from sheer poverty, want of water, etc.; hundreds are killed every year by the burr of the plant common all over this and every Southern and Western State, called "cockle burr." When these sprout and first show above the ground in the spring they are eagerly sought after by the hog, the meat or kernel being rich almost as a nut, but the spikes on the hull are perfectly indigestible, and will kill as "sure as shootin'." Hogs whose bowels are out of order can be started on the mend by parching corn for them—throwing the corn, husk and all, in the fire. The burning of the husk off thoroughly will generally roast the corn sufficiently.

SAN AUGUSTINE.—There was some complaint of hogs dying of cholera about a year ago, but I think it very probable that they died from some other cause, eating cotton seed, cockle burrs, or something else. I do not know that there has been any hog cholera in this county. I frequently hear persons complain of hogs dying, some say of cholera, but I think it is for the want of attention. Our hogs are turned out in the woods and shift for themselves during our long, hot, dry summers, therefore it is not strange that some of them should take the cholera. Hogs are generally healthy here if properly attended to. There is some complaint of fowls dying with what some people call cholera.

SAN SABA.—We have no hog cholera in our county or any other disease worth speaking of. Hogs depend on the mast for a living, which makes them exceedingly healthy. No losses except by disease known as poverty.

SHELBY.—The oldest citizens say that the disease called hog cholera first made its appearance in 1863. Hogs prior to that time had been healthy. They can not tell how it made its appearance. I am an Alabamian, and the same disease made its appearance in middle Alabama in 1863. We have found no certain cure. Some use one thing, some another, but I use Salmon's hog-cholera mixture. I find it cures.

SOMERVELL.—We are troubled very little with hog cholera in this county. It made its appearance here in the fall of 1876, and the loss sustained was about 33½ per cent.; but since that date we hear but little about it. The disease generally originates about gin-houses, where the pigs have access to cotton seed, which is almost certain to prove fatal to young hogs. The failure in our grain crops is all that prevents us from having one of the best hog counties in the West.

STEPHENS.—The "oldest inhabitants" say that hog cholera has never made its appearance in this county.

TITUS.—Hog cholera made its appearance here during the year 1879, just at the time the people began to try to improve their old stock by the purchasing of Berkshire and other breeds from the Northern States. I have been living in this county since 1852, and I never heard of hog cholera until 1879. Since that time it is quite common. The general belief among the people here is that it originated from the Northern hog brought to the South. The Southern-raised hog, up to that time, was very healthy, and seldom ever died from disease. The hogs that have died this year have almost invariably been those that were large and fat.

TRINITY.—Hog cholera has existed here for a number of years; the date of first appearance can not be correctly ascertained. Some years it is more fatal than others. It proved very fatal during the year 1887.

THROCKMORTON.—We have no hog cholera in this county. Never heard of a hog dying of the disease here. No disease of any other kind prevails among hogs.

UVALDE.—The disease known as hog cholera is unknown in this county.

VICTORIA.—Hog cholera is not known in our county. There are very few hogs raised for any other than home use. The number is decreasing, as a due regard for economy may dictate.

WALLER.—Many hogs died during the dry summer season, all under the name of cholera. It was, however, confined to certain localities and did not prevail generally. Sheep have been to some extent affected with scab, but horses and cattle have remained free from disease.

YOUNG.—Hog cholera has never been known in this county.

UTAH TERRITORY.

BEAVER.—There are no diseases of any kind in this county, nor in the Territory that I know of. There is a little scab among sheep at times, but a very small percentage of animals die—not enough to mention. The sheep are dipped twice or three times a year—hence the disease is kept down very well.

CACHE.—Have no hog cholera in this county—never had any—don't want any. Almost our entire loss among horses is caused by distemper. Cattle have been affected with black leg and sheep with scab.

DAVIS.—We never had any hog cholera here. The only losses sustained among any class of farm animals during the present year has been among sheep.

EMERY.—We can not learn of any cases of hog cholera in the county.

IRON.—No hog cholera known in this county. A number of young pigs have died, but I do not know of what disease.

KANE.—Hog cholera has never been known here. No disease among hogs at all. Have no knowledge of there ever being a sick hog in the county. No farm animals are ever lost here by disease.

MILLARD.—We have had no hog cholera in our county. For a short time last spring it looked as though black leg would carry off most of our young cattle, but it soon stopped. Horses, sheep, and hogs are in good health.

MORGAN.—No cases of hog cholera have been reported this year. The disease has never been bad enough to create any alarm.

PIUTE.—There is no disease among the hogs called cholera. Hogs are healthy as a general thing. Sheep have been somewhat affected with scab, but no material loss has occurred.

SAN PETE.—Hog cholera is not known in this county. During the past year horses and cattle have been free from all diseases. Sheep are also free from disease. Grazing principally upon the mountain ranges, they do not seem to contract disease.

SEVIER.—On inquiry, and so far as my observation extends, no disease exists in this county either among horses, cattle, sheep, or hogs. The weather is quite severe at the present time on stock on the ranges, but as yet none have been lost through exposure. The people are better prepared to look after their stock by having good stacks of straw, chaff, meadow hay, and lucerne. Animals will and do die occasionally, but not because of any contagious disease prevailing. Better grades of cattle are being introduced at considerable expense, mainly Holstein, but they are kept up and housed and fed, and are well cared for. A thorough-bred Holstein bull cost about a year ago, at one year old then, \$250.

UINTAH.—There has never been to my knowledge a case of hog cholera in the county. A few animals die occasionally from what is called black-tooth. Perhaps a half dozen died during the year. Only two or three hogs are kept for a family in this county.

VERMONT.

CALEDONIA.—There is not to my knowledge any disease among hogs known as cholera. I have lost a few shoats, dying suddenly, for whose death I could find no adequate cause, being apparently quite well and be dead within an hour. They would give a terrific squeal and drop dead. The carcass would become putrid very soon. Sometimes all in a pen would die; again, only a portion would die. I have no means of knowing what the disease was. It was not wide-spread—only now and then an instance of it. There has been no prevailing disease among live-stock during the year in this county.

ESSEX.—There is no hog cholera in this county. All kinds of farm animals have been unexceptionably healthy.

LAMOILLE.—No case of hog cholera has ever been known in this county, nor has any other disease prevailed to any extent during the past year.

WINDHAM.—No contagious or epidemic diseases prevail among the cattle of this county. Hog cholera is unknown here.

VIRGINIA.

ALBEMARLE.—Hog cholera has been prevailing in this county for more than twenty years past. There has not been so much during the last twelve months. I think the disease is abating in this county.

AMHERST.—From old residents of the county I learn that the disease known as hog cholera appeared some time before the war. How or when introduced none can give any satisfactory answer. During 1887 there was no cholera in the county. Sometimes a locality will be exempt for several years, and then again the disease will prevail for two or three years, sometimes one year and then an intermission. Every disease affecting the hog is called cholera, while the symptoms are often quite different. From the best information I can gather hog cholera appeared in the county about forty years ago.

BATH.—There have only been a few cases of a disease supposed to be hog cholera in this county.

BEDFORD.—The care and condition of live-stock during the year are very much the same with us as from time immemorial. It is hard for us, it seems, to get out of the old ruts. Few persons shelter their stock, and but little care or attention is paid to feeding. Hard as have been the times with us, our necessities have not yet taught the virtue of utilizing every source of profit. As to hog cholera, I do not remember the year of its first appearance with us, though I can well remember when the only losses among hogs were from eating mushrooms, after long wet spells. Great losses have been sustained in recent years. The last year nearly swept them clean all around me, as well as in many other parts of the county. Horses, cattle, and sheep have had no disease to do any serious damage for several years past. I am unable to give any information as to the introduction of hog cholera or an approximation of losses.

CHARLES CITY.—There has been no general prevalence of hog cholera this year. In one or two cases the loss has been heavy, but the disease has been confined to the farms on which it originated. One large farmer, for instance, lost about 80 head of hogs and shoats, but none were attacked on the adjacent farms. The cholera has been in this county for at least fifteen years. There is no means of knowing how it was introduced. Previously the hogs were healthy. Now the disease it always with us, but varying very much year to year, breaking out in the herds first is one neighborhood and then in another, without any apparent cause.

BLAND.—There is no disease among any stock except hogs. This disease, known as cholera, commenced 30 miles west of here some two years ago (though it has been farther west for several years). It reached this county slightly in the fall and winter of 1886. Last summer (in June) it raged here, leaving some farmers one animal, and some none at all, according to size of herd. West of here, where it killed so many a year so ago, they did not have it last summer. I think it is an epidemic that passes slowly east. It has now got about 7 miles from here since last June. The disease is very fatal. It kills some at once; some linger a month or more, then die; some peel off as if scalded. They get well. It is like small-pox in man. If it does not break out they die. I bought a patented hog medicine and used it with success. I had three animals that were blind and could hardly stand, and with difficulty could swallow. I gave them this medicine according to directions. They got well and hearty. I think it as good a preventive as it is a cure.

BOTETOURT.—Hog cholera appeared in this county about the year 1872, but not in a very malignant form. How it was introduced is somewhat of a mystery. It prevailed in the counties north of us a year or two before it reached here. It seems to have reached its zenith here about four years ago, since which time its malignancy has gradually abated. When you want to be on the safe side in reference to a cure for hog cholera, just say it is so far without an antidote; there is, however, a treatment, not with medicine, but a quarantine treatment, and the cremation of the carcasses of the dead ones will stamp the disease out in a reasonably short time. I speak from the book. My manner of treatment was published in the "Industrial South" several years ago; would gladly reproduce it if there was any hope of its general use in localities where the disease prevails. There is no prevailing disease among cattle or sheep.

BUCHANAN.—The disease known as hog cholera was first introduced in this county thirty or thirty-five years ago by hogs being driven to market through the county from Kentucky. Previous to that time there was no disease among hogs. No disease has prevailed among domestic animals except a few isolated cases of hog cholera last spring, and not exceeding \$50 worth died.

BUCKINGHAM.—In 1886 a disease quite fatal appeared among hogs in different parts of the county, which was supposed to be cholera. It decimated hogs in the county, and created great fears among hog-raisers, but it has very nearly disappeared almost as suddenly as it appeared. There are no apprehensions among farmers in regard to it now.

CAMPBELL.—Hog cholera has not been as general as for some years past, and some sections have been entirely free from the disease. When it prevails, however, the mortality is very great, especially with young hogs. There has been a great scarcity of hogs for several years and the large sums of money that go out of the county for meat is a serious item. I have heard of no cattle plague in any other section than around Evington, where some 40 cattle died with what is called Texas fever. Some disease called pink-eye has prevailed with horses, and a few have died from this cause. It is common to give sulphur, copperas, ashes, and salt to hogs, with the belief that it is beneficial to prevent disease.

CAROLINE.—Hog cholera made its appearance in this county in 1886. I do not know how it was introduced. It was fatal except in a few instances. Many experiments for the cure of the disease were tried.

CHARLOTTE.—As to how or when hog cholera was first introduced I have not been

able to ascertain, but the disease can be clearly traced back for fifteen years, during all of which time it has been more or less prevalent and always very fatal. The disease prevailed in this neighborhood for several years, but was kept off my estate by close attention to hygienic means, viz., cleanliness, change of range, use of salt and ashes all the year round, and turnips during winter when the animals begin to cough. When, however, the hogs of two neighbors which were on either side of mine were seriously affected, there was no escape. Since that time it has been more or less prevalent in the neighborhood every year. Prior to the introduction of cholera hogs were healthy, being kept on ranges and never penned until put up to be fattened for pork. The only limit to the number raised was the amount of mast or natural food furnished by the range and the size of the corn-crib. The preventive measures recommended by the Department have proved efficacious in arresting the progress of the disease. Diseases have not been more prevalent than usual. Some cases of a new disease among lambs have been reported which have proved quite fatal, particularly to buck lambs, but its cause, nature, and origin are unknown; should it prevail again I shall ask for an investigation by a veterinary surgeon.

CRAIG.—Hog cholera does not prevail annually in our county. It has made its appearance here about once in every five years, but when it does attack swine it generally makes a clean sweep. The disease generally lasts about three days before it causes death, sometimes not more than twenty-four hours. Some hogs get over the disease. They generally break out in pustules, and shed all their hair. Nothing has proven beneficial as a remedy for chicken cholera. I will give a specific which has been doing wonders, though you will say it is worthless because it is so simple. Fresh-churned butter clear of salt will cure the worst cases I have seen. Fowls not able to walk when fresh butter is crammed down their throats recover in a few hours. Horses, cattle, and sheep are free from contagious diseases.

FAUQUIER.—Hog cholera has prevailed in this county to a greater or less extent for nearly ten years. There is much less of it now among the hogs than for many years past. Nevertheless, hogs are scarce, no doubt from the fact that the hog-raisers had become discouraged by their great losses in previous years from cholera, and did not attempt to raise many hogs this year. The scarcity of hogs in the county is doubtless the reason to some extent why the hogs now on hand are so healthy. There will not be many more hogs raised in this county this year than enough for home consumption.

GLOUCESTER.—Hog cholera made its appearance in this county about fifteen years ago, and is supposed to have been brought in with the introduction of an entirely new breed of animals.

GOOCHLAND.—Hog cholera, as well as I can learn from the oldest inhabitants, made its appearance in this county about thirty-one years ago. I can not find out anything reliable as to its cause. Up to that time hogs were very healthy and profitable as a money crop. It would seem that in late years there have not been enough raised to provide meat for home consumption.

HALIFAX.—The hog plague—cholera—first made its appearance in this county during the fall of 1866, when it killed more than half the hogs in the herds attacked. Portions of the county which escaped the disease in 1866 were visited by the scourge in 1867; and it is a reasonable estimate to place the loss of hogs for both years at 70 per cent. of the entire number in the county. Very few of those attacked recovered. Since then quinsy and measles have prevailed, killing many hogs. The hog plague again prevailed in the county, culminating in the almost entire destruction of herds, in 1886; since which time hogs have remained comparatively healthy. As late as thirty years ago hogs were considered about the healthiest of farm animals, rarely dying except from eating poison mushrooms after wet seasons in summer. Cholera was entirely unknown here before 1860. A few cattle annually die of splenic fever. Sheep are the healthiest of all farm animals here.

HANOVER.—We consider hog cholera incurable, and that an ounce of prevention is worth more than a pound of cure. Keep hogs in pastures containing pure, fresh water, and let them have access to a mixture composed of salt, sulphur, hickory ashes, and tar, and feed good, sweet grain, and they may escape the disease.

HENRICO.—There has been no hog cholera in this county that I have heard of except among a lot of hogs fed on city garbage, which nearly all died from so-called disease. I have a number of times known of hogs dying when fed on hotel swill, with a disease much like cholera. Sheep are usually healthy. Occasionally one dies with grub in the head, but there has been no foot-rot to my knowledge for years.

HIGHLAND.—The general health of all animals has been good during the past year. I can give you no particulars as to the mode of the introduction of hog cholera into our county. Neither do I know what year it made its first appearance.

ISLE OF WIGHT.—From the best information I can gather through my assistants and others, hog cholera made its appearance in this section between 1855 and 1860. At first it was thought to have been caused by mushrooms or some other poisonous substance obtained by the hogs, but this idea was abandoned after it was found that the disease was contagious. On my own farm, which I have been cultivating for forty years, I never had the disease until 1866. Since then it has been on my place often, until I adopted the plan of not allowing the hogs to be in contact with others, and not allowing them to go on pastures where the diseased hogs had been for two or three years. This is the only preventive which seems to have been effective, and in this I am borne out by my experience as well as that of many others with whom I have consulted. We have tried many remedies, but none seem to be efficacious. Isolation and attention is the only preventive. No diseases of horses, cattle, or sheep have prevailed in this county for the past year. Such as have died, the deaths were caused by such diseases as usually occur among animals. Hogs have died in considerable numbers. From the best I can learn, I suppose that one-fourth at least of the stock left over last year have died of cholera. Another correspondent writes: "Hog cholera first made its appearance in this section in the year 1866. Hogs were comparatively free from all diseases prior to that year. How it was first introduced is still a mystery. There are many theories but no unanimity of opinion. There is an opinion current here that the disease is largely due to the use of manipulated guanos containing the blood and bones of diseased animals, strongly contending that the diseased germ is not destroyed by the process of manufacture and re-introduction to the soil. One correspondent writes that 'it was seldom a hog died before the war; then every farmer had his tar-gourd at his hog pen, and used salt and ashes liberally with their food,' and adds: 'I find it a very efficacious remedy even now.' There is a better feeling in reference to caring for stock, yet it is not what it should be, as the major part are allowed to roam the common and seek shelter in the woods. I can secure no intelligent or satisfactory report of the loss by disease of horses, sheep, and cattle. There is no epidemic prevailing among them."

JAMES CITY.—Hog cholera came with the war—was supposed to have been introduced with Western forage for the army horses. Before its introduction our hogs were remarkably healthy, the worst scourge then being the mange. As hog cholera cases are becoming scarcer every year, the hope is entertained that it is wearing itself out.

KING GEORGE.—Hog cholera has been more or less destructive for the last ten or fifteen years. There is no known cause for its appearance, but I am of opinion it is most prevalent when the stock is not properly fed and sheltered. Last year I lost 60 head by the thriftless management of a worthless manager, which he conveniently ascribed to cholera; but I have always believed the loss was caused by pure neglect. I have never lost any animals that were in really good condition except in one pen of fattening hogs, which could be ascribed to cholera. They laid down before my own eyes, one after another, with a choking cough, and died; but being satisfied that the symptoms justified the conclusion, I thoroughly investigated the matter by opening some of them, and among other things applied the water test with the lungs or lights, and I found I was justified in my suspicions. When I came to inquire more closely into the cause, it turned out that the salt intended to last a month had been given to them at one time; and not having been sufficiently supplied with running water they naturally succumbed to poison by chlorate of soda.

KING AND QUEEN.—This subject of hog cholera has given our people a great deal of serious concern. It prevailed to some extent in the year 1878-79, after which time the hogs seemed to be in good health up to the year 1885, when the disease made its appearance again; and during that year and 1886 it became an epidemic, and very few, if any, escaped its ravages entirely. This year there have been no cases heard of except where they have been imported, and almost invariably the disease has reappeared with them, but not with original stocks. I have found most beneficial results from the use of salt, ashes, and sulphur as a preventive, and carbolic acid with those that are sick. Though the disease generally proves fatal, yet there are some mild cases if preventives are used and a few cures effected in more violent cases.

LEE.—Horses are in fine health and condition. I never saw cattle in better condition in this county. The spring growth of grass was sufficient to last them during the drought. Hogs are more healthy than usual, and in fine condition. Mast enough to winter our young hogs, though I doubt whether it is much advantage to us in the end, as they are more liable to cholera the next spring. The first case of the disease that I know of was in a lot of hogs that I bought in Bourbon County, Ky., which I summered and fed in the fall of 1848. In that lot I lost 2 hogs of that

disease, though I saw nothing more of it for several years. Previous to that time hogs were healthy, with the exception of a little quinsy in very dry weather.

MADISON.—The first appearance of hog cholera in this county was in the year 1862. It was so malignant that dogs eating of the carcasses would live but a short time. The disease was in a milder form until the last two years, when in many instances it took the last hog from some farmers.

MATHEWS.—Hog cholera made its appearance in this county about fourteen years ago. For the last five years it has been much worse, many persons losing all they had. Previously the disease was unknown. Many persons advocate the regular use of salt and ashes to eradicate the disease; others say nothing but the burning of the dead and dying has proved effectual.

NANSEMOND.—Hog cholera first made its appearance in this county during the year 1861. The symptoms were vomiting and purging. Sometimes the animals were troubled with cough, and frequently with cutaneous eruptions. For several years afterwards this disease recurred at irregular intervals, but then a different form of cholera prevailed, equally if not more fatal than the original disease. Perhaps this later disease is not cholera. Indeed I am decidedly of the opinion it is not. Don't know anything of its origin or mode or means of its introduction, but previous to 1861 no disease was known among hogs in this county or section of the State.

NEW KENT.—No cholera this year. Hogs have been subject to the disease at various times for the last fifteen years. They were healthy before that time.

NORTHUMBERLAND.—The first appearance of hog cholera in this county occurred during the year 1863. It was very fatal that year. Since that time it has occasionally made its appearance, but not fatally or generally over the county. In some localities it was bad last year. We generally consider the hog worthless after an attack of cholera. If it does not die it never amounts to much. We know of no remedy. The disease usually occurs during fall, when the hogs are in good order and on pastures, and it can not be attributed to filthy pens.

ORANGE.—Hog cholera first appeared in this county in 1884, but was most fatal in 1885. Twenty-five per cent. of those affected died. Don't know how it was first introduced. Has been sporadic in its attacks, never affecting all the herds in a neighborhood, some farms losing all while the next neighbor would lose none with no apparent difference in treatment. No established preventive or remedy has been found. My hogs have never had it. They have salt and ashes freely, which no doubt conduces to general health, and enables the animal to resist the contagion. Before the appearance of cholera hogs were generally healthy. A few cases of scours in calves and colts have been reported. Farm stock generally entered the winter in good condition, and there is abundant forage. Ensilage is becoming more popular, and stock is better sheltered and cared for.

PITTSYLVANIA.—I think hog cholera first made its appearance in this county about the year 1874. Previous to that time it was unknown. Since that time I suppose one-half the hogs in the county have died. No remedy has yet been discovered for it, as far as I know. I am inclined to think that hogs bedding in old straw or in old houses where it is dry and dusty are more liable to the disease. Last year I lost more than two-thirds of my hogs. This year I have paid more attention to their bedding, furnishing fresh leaves and tobacco stalks for bedding, and early in the spring I put them in my apple orchard where there was plenty of clover and green apples. Although nearly all of them had the cholera it was in a mild form, and none of them died. I also gave them sour slops once a day. I shall continue the same treatment for the next year.

PRINCE GEORGE.—Up to 1884 hog cholera was not known in our county, but in 1884-'85 it swept off every hog some of our farmers had. The cause of the disease has never been known to us, but I have never known a herd that was in good condition and well cared for to have it. It has been all around me within a half mile each way, but I have never had a case yet. I keep a slop barrel in my lot, and have all of the slops from the cook room put in it and fed to the hogs. I attribute my escape to the grease and soap that is in the slop water. I know of no other reason, as I have never used any other preventive. I am not a large hog-raiser; from 30 to 50 head is generally the extent of my stock.

RAPPAHANNOCK.—The hog cholera in our county has been local this year. Soon after the close of the war the disease made its first appearance here. Before that time hogs were generally healthy.

RICHMOND.—Hog cholera, or a disease very much like it, commenced down here in the summer and fall of 1885. In 1886 it was very bad, some losing nearly all their hogs, and what few remained did not do well. Meat was very scarce, so that it had to be shipped down from Baltimore. But this year has been free from disease, though not a full supply raised, that is, as many as three years ago. All other stock free

from disease and in very fair order. There are quite a number of stallions in the county, so we are raising quite a number of colts.

SCOTT.—The disease known here as hog cholera first appeared about twenty-five years ago. Previous to that time hogs were generally healthy. The means of its introduction or the cause is not known. The past year cholera has not prevailed here to any great extent. The present year the general health of hogs has been tolerably good. I have never known all classes of farm animals freer from disease than the past year.

STAFFORD.—Hog cholera has abated very much during the year, one reason being, I suppose, a reduction in the number. It first made its appearance in this county about thirty years ago, from no perceptible cause. Previous to that time hogs were healthy. It is confined to certain localities at a time. After killing most of the stock it disappears, and frequently does not make its appearance again for some six, eight, or ten years. Hogs in good condition are equally liable to it, and sometimes whole pens ready to be butchered are attacked. I think it may be kept off sometimes by freely using salt, ashes, and charcoal.

SUSSEX.—A disease called hog cholera prevailed in this county previous to this year to quite an alarming extent. In some sections the farmers lost almost their entire stock of hogs by the disease. This year, however, it was noticed but little, therefore the outlook for hogs is better than for several years. The disease generally attacks the hogs about the 1st of June, and continues until the first frost or cool weather.

TAZEWELL.—For two years—1886 and 1887—fully 50 per cent. of the hog crop was swept away by cholera. The number has been reduced far below the needs of the population. The disease has prevailed in circumscribed localities in different years, and has done so for many years, but during the years mentioned it was frightful. No period or cause can be stated for its appearance. It seems now to prevail at all seasons.

WESTMORELAND.—Hog cholera first appeared in this county in 1883. The means or mode of its introduction are not known. Previous to the above date our hogs were generally very healthy and subject to no disease. In 1884-'85 its ravages were particularly severe, and many farmers lost their entire herds. In 1886 the disease began to abate, and in 1887 almost entirely disappeared.

WISE.—There was some hog cholera in our county the past fall and this winter, but it was not so general or fatal as in the year 1885.

YORK.—Hog cholera made its first appearance in this county about the year 1870. Prior to that time our hogs were generally healthy. It seems that with the introduction of what we call the improved stock came this disease known as hog cholera. It is sometimes confined to certain localities; then again it strikes pretty generally through the whole county. Sometimes it attacks the hog in one way, then again differently altogether. In 1885 it was pretty general throughout the whole county, assuming somewhat the scope of an epidemic; and the nature of the disease seemed long and lingering, scarcely any hogs dying suddenly. If any survived it would be after a long illness, and they were miserable looking objects, perfectly hairless. In 1886 it was confined to localities, and was very fatal and quick in its destruction. This year we have scarcely heard of a case. We have been using as a preventive spirits of turpentine.

WASHINGTON TERRITORY.

ASOTIN.—There has never been a case of cholera among hogs in this part of the Territory. They have been remarkably free from disease of all kinds. There has been a disease among cattle the last year called black leg. It affects young cattle principally, especially calves. I have no way of making a correct estimate of the number affected, nor can I tell exactly the number lost by this disease.

CHEHALIS.—There is no such disease known as cholera among hogs in this county. They are remarkably healthy, as are all other classes of farm animals in this county.

CLARK.—Very few hogs are raised in this county. There never has been a case of hog cholera here. Very little corn is fed to hogs. They are fed principally vegetables, pease, shorts, and some green corn. Horses and cattle have been healthy.

COLUMBIA.—There never has been any hog cholera in this county that I can hear of. Hogs are very healthy. Horses, especially young ones, have distemper pretty badly occasionally. Cattle have no disease here.

DOUGLAS.—There has not been a case of hog cholera in this county since its settlement, to my knowledge, and I was among the first settlers.

FRANKLIN.—There are but few hogs raised in this county and hog cholera is something entirely unknown among them. Farm animals generally are healthy.

ISLAND.—Hog cholera is something we know nothing about in this county except as we read of it as prevailing elsewhere.

KITSAP.—There has been something of the nature of hog cholera existing in Skagit County, some 60 miles north of this locality. Quite a number of hogs have died there. All here appear to be perfectly healthy.

KLIKITAT.—So far as my knowledge extends hog cholera does not exist in this county or Territory. I have been a close observer of the physical and natural development of this animal, and in this section of the county I find the organs of secretion perfectly developed and clear of disease. Where I formerly lived, in Missouri, this healthful condition of the liver and kidneys did not always prevail. The liver was usually badly ulcerated, the kidneys and bowels pregnant with worms. Under such conditions it is impossible for an animal to enjoy good health.

LEWIS.—There has never been a case of hog cholera in this county. Hogs are very healthy here and no contagious diseases prevail among them. Horses, cattle, and sheep have died during the past year, but none with contagious or infectious diseases.

LINCOLN.—There never has been a case of hog cholera in this county.

PACIFIC.—There has never been any contagious disease among hogs in this county. But few sheep or hogs are kept, owing to the depredations of bears.

PIERCE.—We have no such disease among hogs as cholera or any other disease. No diseases among horses, cattle, or sheep. Now and then an animal will die, but generally from ordinary causes.

SKAGIT.—A disease called cholera has extended over about one-fourth of the county. It does not act like cholera. The hogs would be sick a month or more, would draw up their backs and act as though they were cold. This was in August and September. About one-half of them died. The remainder do not seem to be entirely well yet. About 400 head died. There is now a disease among cattle confined to a small portion of the county. We can not make out what it is. Lumps come on the jaw and breast, which, after from four to ten weeks, begin to discharge matter. Some get better, but do not seem to entirely recover. Some have to be killed to get them out of their misery. We would like to know what it is and how to treat it.

WAHKIAKUM.—I have been a resident of this county twenty-one years and have never heard of hog cholera prevailing here. I think there has been no such disease in this county.

WALLA WALLA.—Such a disease as hog cholera has never made its appearance in this county. There has been no disease of any kind affecting domestic animals in this county, except scab in sheep, which only injures the wool clip.

WEST VIRGINIA.

BERKELEY.—This county has been troubled for many years with hog cholera. I can not state the year it first appeared.

BOONE.—No diseases among horses other than distemper, bots, etc. Hogs have been healthy this year, what few we have, for nearly all died last year with what we called hog cholera. I have no idea of any producing cause, or of any effective remedy, though many were tried. The present year has been a remarkably healthy one for all kinds of farm stock. A few cattle, as usual, have died of a disease generally known as murrain.

CABELL.—We have had but little hog cholera during the year in the county. As a general thing there have been no remedies administered. Some of the farmers use soft soap, others sulphur and coppers, but we have had no remedies that will in the least check the disease when once it starts in a lot of hogs. It is permitted to run its course, as the remedies applied do not seem in any case to have a beneficial effect.

CALHOUN.—We have had the so-called hog cholera off and on for twenty years, occasionally a family of hogs dying of it. I have paid close attention to it, having had experience with it in Massachusetts thirty years ago, and have come to the conclusion that in most instances it is caused by in-breeding, but I never knew of an instance where hogs had plenty of salt, lime, and water where there was a case of it. I lost a whole family twenty-three years ago, and have never lost one since, while my neighbors have lost heavily, although they had my advice as to the cause.

DODDRIDGE.—I do not know of any hog cholera in this county. A few years ago some persons brought some hogs here from the State of Ohio, and some of them died with cholera. I think the last of them died here for want of something to eat. A great many persons keep more hogs than they have feed to supply them with. With the exception of calves we have had no great mortality among any class of farm animals.

FREMONT.—To the best of my knowledge there has never been any disease known as hog cholera in our county. No hogs are raised for market. Every ranchman tries to have a few for his own use. Don't think there was ever a hog fattened here on corn. Hogs are of a good grade, but we only have a few in our county. A few horses supposed to be affected with glanders have been condemned and killed by order of our citizens.

GILMER.—Hog cholera is a disease scarcely known in this county, and I very much doubt whether there ever was a real case in the county. This may be attributed to the fact that there are no large herds, and the hogs are not confined in large numbers in close and uncomfortable pens. There has been no prevailing disease among any class of farm animals during the past year.

GRANT.—Hog cholera was introduced into the adjoining county (Hardy) four years ago, from a lot of hogs brought in from the West. Shortly after they commenced to die. Soon it spread in the neighborhood. The farm on which they were placed is some 4 miles below Moorefield, on the south branch of the Potomac. Next year it came up to Petersburg on the same stream in this county, where a considerable number died. The following year it came down in my neighborhood, on Patterson's Creek. I was the first and only one below the mountain that lost by the disease. How they got it I can not say. My hogs run to the pike and some hogs that were affected were driven down the road. These hogs were infected up on the mountain 3 miles from here, and they certainly did not come in contact with mine. I lost 10 last summer; they were sick all summer and at last they died. The following winter my next neighbor's hogs were attacked. He lost some 20 head. Last year (1886) we heard little about it, but this year it has been very fatal and many have died.

HANCOCK.—A disease has prevailed among the hogs of this county the past fall, stated in my last regular report. It is generally regarded as being hog cholera, and has been so pronounced by Dr. Queen, a veterinary surgeon, of Steubenville, Ohio, who was employed by the board of health of this county to investigate the subject. The doctor's opinion is, however, called in question, as you will see from the inclosed clipping made from a local paper (the Hancock Courier) of this day's date:

"The Steubenville Gazette says: 'Dr. S. E. Queen, veterinary surgeon of this city, being called to Chester, Hancock County, W. Va., to ascertain the character of a disease that was proving fatal to many hogs in that neighborhood, reported to Dr. P. C. McLane, of New Cumberland, president of the county board of health, pronouncing the disease typhoid pneumonia, commonly known as 'hog cholera.' He further says regarding the disease: 'It appears to arise from contagion and infection only. When an animal is noticed unwell it should be at once isolated or destroyed and the healthy ones removed from the pen or lot and all litter and excrement burned and the inclosures cleaned and disinfected. Would also recommend that all hogs dying from the disease should be cremated. No specifics have yet been found that would cure or eradicate the epidemic.'

"Dr. Queen may be the king of horse doctors, but a gentleman from Grant district informs us that the disease is not 'hog cholera' at all. He says that the genuine hog cholera operates upon the animals the same as the Asiatic cholera does upon human beings, by purging, etc. In this disease there are no such symptoms, but the reverse, and that the animals become feverish, etc. The doctor may be right about its being incurable, for, so far as our knowledge extends, there's no cure for any kind of cholera."

No disease exists among either horses, cattle, or sheep, and I make no return as to them. The hog disease is confined to a single locality—the northern end of the county—and has almost wholly abated.

HARDY.—The disease generally known as hog cholera first made its appearance in this county in 1880. Many of us never believed it was cholera. It has the appearance of a lung trouble, beginning with a dry cough and continuing sometimes for from four to seven weeks, or till the hog is nothing but a shadow. They do not eat well, and seem to die from starvation. I have known one-half of a drove to die and the others not to be affected at all. There has been less of it recently; in some places where farmers have burned or buried the dead ones there is none of it at all. The raising of horses and mules is gradually increasing, while raising cattle and sheep is decreasing. I think the increase in the horses is at least 30 per cent. greater than five years ago. They are generally healthy, and are kept in stables and sheds in rough weather. Some cattle have died of black leg, and a few from hollow-horn as it is called. About all afflicted with the former die, whilst the latter are often saved by boring the horn and applying turpentine. Some sheep have died from grub and some from stomach worms, which latter we have learned to remove with copperas administered in small quantities in the feed.

HARRISON.—Hog cholera does not prevail in this county. Large numbers of

sheep are raised in this county, which are shipped when quite young to the New York markets.

KANAWHA.—Previous to the year 1880 hogs were remarkably healthy in this county. In that year, and also in 1883-'85-'87, the so-called hog cholera made sad havoc among the hogs, especially among fat hogs. The disease came like a blight, without any apparent cause. Hogs that had been kept upon good pasture and well cared for, and having no opportunity to get the disease from outside, were equally diseased. Young hogs once attacked by the disease and recovering are never again liable to take the malady. Dr. William Mairs, who lives in the northwest end of our county, writes me that about 50 fat hogs died in his section this fall from the so-called cholera. But the doctor says the disease is not and never was the cholera, but is a brain and throat trouble. Aside from the 50 deaths reported by Dr. Mairs, I hear of no disease among hogs in my county. It was formerly thought that the free use of apples would prevent the disease, but my hogs died in the orchard last year while the ground was covered with fruit.

McDOWELL.—There has been but little hog cholera in this county in the last year. I am unable to ascertain the exact year of the first appearance of the disease, but I believe about ten years ago. From what I can ascertain hogs were generally healthy before that time.

MARSHALL.—I am proud to say that we have had no hog cholera in our county for several years past. Hogs are fed on soft food, and run in fields of clover. Farm animals throughout the county are exempt from disease.

MINERAL.—Hog cholera first made its appearance in this county about fifteen or twenty years ago. It seldom, if ever, extends all over a county in one year, but usually confines its ravages to one or two districts the next year; but sometimes, when there is anything left for it to feed upon, remains two or three years in the same district. Previous to its appearance here there was seldom any loss by disease among swine. By what means, or from what cause it was first introduced, is still as great a mystery as at first. There had been no cases in my immediate neighborhood for several years, until last fall, when a drove from Hardy, an adjoining county where the disease prevailed, passed through here, and soon after it commenced its ravages here among several herds; but whether introduced or not by this drove seems uncertain, as the same drove had passed here without communicating the disease so far as known. No preventive or remedy for this disease is known, though it is supposed by some that hogs raised principally on grass suffer less from it, and are less liable to its attacks. My experience, however, does not corroborate this opinion.

MONONGALIA.—I don't think there has been a death from cholera among hogs in this county.

MORGAN.—The introduction of hog cholera in this county occurred in 1862. Previous to that time hogs were healthy as far as I can learn. As to the cause of the disease I know nothing. Calomel, alum, and poke-root have been used to good effect at times by putting into swill; but I have never found a sure remedy or preventive for the disease.

NICHOLAS.—We have had no cholera among our hogs for some years past to amount to anything. In some localities, perhaps, some few hogs would die with it, but not in sufficient numbers to attract serious attention.

OHIO.—I am pleased to state that hog cholera has been entirely stamped out of this county. So far as my inquiries have extended there has not been a single case this season. All the disease we have had among this class of animals was due to poor sanitary conditions. As to the introduction of the disease, I would say that in 1880 a car-load of Western hogs was shipped into this county for feeding purposes, which proved to be affected with the disease. These were the first well-defined cases of the disease known here. There has been more or less every year since until this year. Horses have been healthy. The usual amount of foot-rot has prevailed among sheep. This disease is not usually fatal, but lowers the market value of the stock 50 per cent. There has been an unusual fatality attending farrowing sows this fall. In some cases they have lost all their pigs. We attribute this loss to the fact that the sows were allowed to run to acorns, which were very abundant this year.

RITCHIE.—There has been no hog cholera in this county for several years past, and then it was brought in with a lot of hogs purchased somewhere in Ohio. Since that time the county has not been revisited by it.

ROANE.—Horses, cattle, and sheep have been nearly free from any disease during the year. Hogs in some districts have been diseased with what the people call cholera. The symptoms vary greatly. Sometimes the ear is affected and they become deaf. At other times they become lame, and sometimes the throat becomes sore, etc.

SUMMERS.—Hog cholera first made its appearance in or about the year 1857. Every year more or less of this disease occurs. This year more hogs have died from

this disease than usual. The disease is always more fatal along the river than in the back country. We have never yet discovered anything that would effect a cure.

TUCKER.—Hog cholera made its appearance in our county about eight years ago, and was brought here from other sections by the importation of stock hogs. The disease has never been so fatal here as in some other counties, and of late years it has not been so destructive as formerly. Prior to the appearance of cholera the hogs of this county were healthy. The drought has been so severe that stock, especially cattle, are starting into winter in poor condition.

WIRT.—Hog cholera first made its appearance in this county in the years 1867-'68. Prior to that time hogs seemed very healthy. The origin of the disease I can not give. There were some cases of hog cholera in the county last year. Five of the hogs died. The others still linger with disease and are worthless.

WOOD.—It has been twenty-five years since we have had hog cholera to any extent. At that time I think the loss was at least 33 per cent. of the hogs. How it was introduced I can not say. Since that time hogs, as a rule, have been healthy. Cattle in our county are not looking well. The very dry summer cut the pastures short, and cattle started into the winter in poor condition. Feed, I think, in the county will be insufficient for the amount of stock to be wintered.

WYOMING.—Hog cholera first made its appearance in our county about the year 1866. Since that time our hogs have not been so healthy. A great many die each year from this disease. Previous to the time it first made its appearance hogs were very healthy. The mode or manner of its introduction in our county is not known. There is no prevalent disease among horses, cattle, or sheep.

WISCONSIN.

BARRON.—No hog cholera in this county. Several colts had distemper last spring, and a few of them died by taking cold through carelessness of owners. Several horses had what was pronounced glanders, and were exterminated. The disease ceased after the destruction of the affected animals.

BROWN.—Hog cholera made its appearance here about ten years ago. I do not know where it came from nor how it came. The first that I knew of it was among our brewers, who kept hogs and fed them chiefly upon barley malt. They lost about their entire droves. The hogs were well kept, mostly, in good, clean pens. A couple of years later I had a drove of about 40 head of various sizes. They were kept in pens and fed largely with weeds and refuse from my garden, I having but a small amount of grain. About the first of September cholera made its appearance among them, and I lost the entire drove except 3 or 4. The above are fair samples of its behavior in this county. Since that time it has disappeared and I have heard nothing of it. I have heard of no other diseases among either horses, cattle, or sheep.

BUFFALO.—No hog cholera has prevailed in the county during the current year. In the year 1885 about one-tenth of the animals in the county died of the disease, but since then nothing has been heard of it.

CALUMET.—About three years ago some losses occurred in this vicinity from what was supposed to be hog cholera. These were the only cases. How it was introduced is not known. Before and since hogs have been quite healthy, so much so that I doubt very much if there ever was a case of the genuine disease in this vicinity. The few losses, and the entire absence of the disease since, leads me to this conclusion. Hogs are in quite a healthy condition at the present time.

CHIPPEWA.—Few animals have suffered from anything like an epidemic during the past year in this county. There has been very little disease among hogs. I think it safe to say that no cholera has prevailed among this class of animals during the current year.

CLARK.—There is no hog cholera in this county. Cattle and sheep are in a healthy condition. Horses are troubled with epizootic distemper, with inflammation on the lungs, caused by overwork and colds.

COLUMBIA.—Hog cholera first appeared in the autumn of 1884, and continued through that winter. Hogs had been entirely healthy up to that time. The disease would break out where no exposure could be traced. Every hog would die on some farms, while others in the same neighborhood would entirely escape. Those that escaped one year would attribute it to some preventive they had used and would say: "No need to have the cholera." The next year their herds would be the first attacked notwithstanding their preventives. Everything about the disease is mysterious. One farmer bought 40 hogs, 20 from one man and 20 from another. Neither had the disease among their herds. The two lots were put together. All of one lot died, while none of the others were affected by the disease. Farmers are

very much discouraged about pork-raising, and from fear of cholera most of the hogs in this county are sold when about half grown.

CRAWFORD.—I believe that hog cholera first made its appearance in this county in 1880. In 1883 it spread all over the county, and thousands of dollars were lost to the farmers by that fatal disease. It seemed that the disease was incurable, but from 1883 it has gradually disappeared. This year, from what I can learn, but few cases have occurred in the county; possibly \$300 would cover the entire loss.

DANE.—Hog cholera was brought to this county from Chicago about five years ago. A farmer purchased a car-load of hogs at the Union stock-yards in that city, and did not discover that the animals were diseased until they were unloaded at the town of Ogden. The disease having gained a foothold decimated several droves on farms of that and neighboring towns; but it did not spread throughout the county, as measures were used with success to restrict it. A little of the disease still lingers in that part of the county. I can not trace it now on more than two or three farms, and on these but a few animals are affected. Previous to the advent of cholera our hogs were healthy. No contagious diseases have prevailed among horses, cattle, or sheep.

DODGE.—About one year ago there were a few small pigs or shoats that died of a disease that I thought at the time was hog cholera, but I am of the opinion that the cause of their death was the extreme cold weather, and their crowding one another to suffocation, as I have had no more trouble since the cold weather passed by. As the balance of the hogs have done well since, it is hardly probable that the disease was anything serious. All of my aids report extremely good health in all kinds of stock.

DOOR.—I do not think there has been any hog cholera in the county this year, at least I can not get an account of any. Neither do I think the small amount of disease among hogs last year was cholera. I investigated several cases of reported cholera, and concluded the difficulty was exposure in some cases, and abuse, with lack of care, in others. I do not know of any disease prevailing among any of our domestic animals. Situated as we are, between Lake Michigan and Green Bay, our air is very pure, our water very good and grass abundant, so the health of all stock is excellent. If there is an occasional ailment or death it is more for want of care or food than any other cause.

FOND DU LAC.—There has been no hog cholera in this county for several years. It came without any apparent cause, and left without any adequate reason. I do not know the cause, but the farming community do not give as much attention to raising swine as formerly. It does not look as though prices were not favorable, as dressed pork is in good demand at \$6.25 to \$6.75 per 100 pounds.

GREEN.—The only disease of any kind in our county is among hogs, and goes by the general name of hog cholera, but from the absence of a proper diagnosis of the disease it may be doubted whether it is the true cholera. Nearly all of the affected animals are first taken with a cough, when death follows. The cough continues to increase in intensity as long as the animal lives. The disease is confined to a small portion of the county, and not all droves are afflicted in the same neighborhood. As to the amount of loss or number of deaths, nothing but a personal canvass of the diseased district can be relied on for a correct statement.

GREEN LAKE.—Hog cholera was first known in this county in the early fall of 1886. It was brought into the county by bringing hogs from an infected district. Hogs in this county were healthy up to that time. The disease has been confined to the two towns of Mackford and Manchester, of this county, according to the best information that I have been able to get. We have lost in this county this year about 2,000 hogs by the disease. It has been fatal in nearly all cases, and usually goes through a whole herd when it gets into one. Some farmers have lost nearly a hundred head.

GRANT.—Hog cholera made its first appearance here seven years ago, and the county has never been clear of it since, and at the present time it is playing great havoc among the stock hogs, all dying that are attacked. I estimate the losses for the current year at \$170,000.

JACKSON.—There is no hog cholera in this county. The disease has never prevailed here. There have been three or four cases of glanders among horses, but veterinary surgeons have stamped out the disease.

JUNEAU.—Hog cholera has prevailed for the past ten years, more or less. The principal cause is supposed to be feeding too much corn, or nearly all corn. Since bran and ground oats and corn mixed has been used for diet, very little cholera has been noticed. Very little disease among horses, other than the common horse distemper. Black leg is the principal disease among cattle. A great many die with it. There is no disease among sheep. Wolves and dogs destroy a good many.

KEWAUNEE.—There is no hog cholera in this county. Stock comparatively healthy—no unusual disease prevailing among any class.

LA FAYETTE.—The exact date of the advent of the disease known as hog cholera into this county is not known. I think it was about 1878-'79; but at that date hogs had begun to be more delicate than formerly, and lung fever had made its appearance among shoats. This was generally attributed to letting the hogs sleep at the straw pile, where they would pile up on top of one another and get very warm. They frequently had to go long distances to the corn-crib and stand in the cold, piercing winds and snow to eat frozen corn. No wonder they contracted lung fever. I have noticed one peculiarity about the so-called hog cholera. In its frequent outbreaks it invariably begins with some one's hogs who has lots of corn, and from this I infer that corn is not the best feed, at least for young pigs and brood stock. Our hogs are like kegs of lard on legs. Vitality and health are in the muscular, nervous, and blood parts of the animal. We breed from young stock that is unfit to perform the duties of reproduction, till our hogs have no constitution, and when an epidemic comes along they die like poisoned flies. Corn breeds worms, worms produce various diseases, diseases become epidemic, and spread in many ways. There are some strangely curious things occurring with this hog cholera. I have had some success with treating it. I believe I have some views on the subject that are not generally known, or perhaps I had better say experience. I have been thinking that I would write them out for some paper if I could only get time. I believe them to be useful not only in hog diseases, but in all diseases of a contagious nature among the human as well as the brute creation, and as we are threatened with cholera it would seem to be of more importance. No well-informed person doubts the fact of these contagious diseases being caused by living organisms in the system, and to kill them or render them sterile and expel them from the system should be the object of treatment. I have followed this view with considerable success, yet I think that a proper person with proper appliances could test the matter more fully and perhaps make great improvements on my system. At any rate I think it worth a trial, and further so because it is so simple and harmless, and can be applied by any one and at a trifling cost.

LINCOLN.—Hog cholera has never appeared in this county.

MANITOWOC.—Hog cholera is not known to ever have existed in this county.

OUTAGAMIE.—Glanders has prevailed to some extent among horses, and 7 animals affected with the disease were killed during the year.

PIERCE.—No cases of the disease known as hog cholera have come to my knowledge. Because of dry weather during the summer and fall pastured stock is in somewhat poor condition. Many farmers are short of winter feed.

PORTAGE.—Hog cholera has never been known in this county as far as I can learn. I have made inquiry from different locations, and from as good farmers as live in the county, and they all agree as to this statement. I would further state that I have never heard of any contagious disease prevailing among horses, cattle, sheep, or hogs, except some fifteen years since, when the epizootic affected the horses in this county.

PRICE.—I have yet to learn of a single case of cholera among hogs in this county. All swine are healthy.

RACINE.—There have never been any cases of hog cholera in this county to my knowledge, or any contagious diseases among cattle.

RICHLAND.—Cholera first appeared among hogs in this county in the fall of 1884. It was quite fatal that season. Up to that time these animals were healthy. They are now free from disease. How the disease was introduced no one can tell. Horses, cattle, and sheep are healthy.

ST. CROIX.—Hog cholera has never prevailed in this county. There has been no general disease among any class of our farm animals during the current year.

SAUK.—The so-called hog cholera occurred in two places in this county during the year 1885; said to have been brought in by pigs imported from Illinois for breeding purposes; but it did not spread far, and was scared out by farmers disposing of their entire stock in the infected neighborhoods. During 1886 it approached our eastern border from Columbia County, and during that summer it crossed into Sauk County, and mowed a swath the entire length of the county north and south, and extended about 6 miles into the county, the infected area being about 6 to 18 miles. The damage I can not estimate, but about every hog died or was disposed of. I do not think 10 per cent. of the usual number was wintered over, and most of those were sold in the spring. This hogless area has not been replenished yet owing to the scare and the scarcity of feed occasioned by the drought, and as a result hog cholera has been virtually stamped out, no cases appearing, as I can ascertain, during 1887.

TREMPEALEAU.—I think there has never been a case of hog cholera in this county. I have a mixture of copperas, salt, charcoal, and ashes constantly where my hogs can get all they want of it. Feeding mostly corn and keeping in filthy quarters is believed a prime cause of the disease.

VERNON.—There is no hog cholera to amount to much in our county at this time. It commenced here and was at its worst eight or nine years ago. There are a few cases now and then, but I have not heard of any recently. Hogs were healthy before the cholera was introduced. The loss of farm animals in this county by disease is very small. Horses, cattle, and sheep are healthy.

WASHBURN.—I have never known of any cases of hog cholera in this county. During the past year all classes of farm animals have been healthy.

WALWORTH.—Hog cholera has never prevailed here to any notable extent. Have no information of value regarding its history or symptoms, its entrance or exit, etc. The hogs of the county are generally healthy, and the losses from all causes (except those occurring at the time of birth) will hardly exceed 4 per cent. Probably a reason for this may be found in the fact that we have no feeders who feed in large numbers, as in the regions south and west of us. While this is true, we have many farmers who each feed from 5 to 50, making a large total fattened and marketed at different seasons during the year, this aggregating a large amount of pork, but not filling to excess the pens at any one time. Another cause for the healthy condition prevailing is found in the mode of feeding adopted by the larger feeders. They are using clover pastures and mill feed largely in growing their pigs. This improves the health and thrift of the pigs, and enables the corn-grower to save much of the contents of the crib. This change has been as much the result of short crops of corn as of improved knowledge of the best modes of feeding. Cattle, horses, and sheep have not suffered from any prevailing disease. Low prices have reduced the number of sheep about 50 per cent. Short crops of grass and grain have reduced the numbers of horses to about 10 per cent., cattle 20 per cent., hogs 20 per cent. or more. These are estimates, of course not exact, but within the facts. Cattle and sheep by the car-load have been shipped (to Chicago and points west where feed can be found) at prices below anything ever known before and still we have not feed to carry the remainder through the winter, except as is purchased at advance prices from the west.

WAUKESHA.—We have had no hog cholera in this county during 1887.

WAUSHARA.—There have been no cases of hog cholera in this county. Indeed there has been no disease of a general nature among any class of our farm animals.

WYOMING TERRITORY.

ALBANY.—There are no hogs of any consequence raised in this county. The few that are bred here are fed on slops obtained at hotels and restaurants, and I have never heard of them dying of disease. The losses from disease among farm animals in the county are insignificant.

LARAMIE.—There is no hog cholera in this county. The only contagious disease is that of glanders among horses. The total number of these in the county is 22,820. About 3 per cent. have been lost by glanders.

CONDITION OF THE CATTLE INTERESTS WEST OF THE MISSISSIPPI RIVER.

Hon. NORMAN J. COLMAN,
Commissioner of Agriculture:

SIR: I have the honor to submit herewith my report as one of the agents of the U. S. Bureau of Animal Industry for the year ending June 30, 1888. In doing so I would respectfully state that I have been traveling almost constantly during the entire period in the interest of the work in which I have been engaged under your instructions. It has been my constant endeavor to do all that was in my power, not only to co-operate with live-stock sanitary authorities to protect Western cattle and other live-stock interests from the introduction of contagious diseases, but to assist the officers of live-stock associations in their efforts to secure improved transportation facilities, better prices for beeves, and other matters affecting the material welfare of the industry.

It affords me pleasure to state that I have had every assistance furnished me that I could reasonably expect by the officers of the sanitary boards and associations referred to, and while our efforts have not achieved that success in all respects that could have been desired, at the same time the country is to be congratulated upon the fact that the entire West has been kept free from contagious bovine diseases, and there is a prospect that measures will shortly be inaugurated which will insure cattle-raisers prices for their products based upon the laws of supply and demand. When this is accomplished the business of beef production will again become profitable, and the large investments in this industry will bring satisfactory returns without in any way increasing prices to consumers of meat.

A report which would embrace in detail all the facts of which I have acquired knowledge would necessarily be too voluminous to interest the general public. I have therefore confined my report briefly to topics of general interest.

SPLENIC FEVER.

A line was established by Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, as marked red on the map facing page 274 of the Report of the Bureau for the year 1885, commencing at the northeast corner of Crittenden County, Ark., and running in a north-westerly course to the northwest corner of that State, extending in the same course in the Indian Territory to a few miles west of the Osage Agency, from which point the line takes a southwest course to the northeastern corner of Wilbarger County, Tex.; thence extending south along the eastern line of Wilbarger and Baylor Counties; thence west along the south line of Baylor County to the northeast corner of Haskell County; thence south along the east line of

Haskell and Jones Counties; thence west along the south line of Jones, Fisher, and Scurry Counties to the northeast line of Howard County, to the southeastern corner of said county; thence in a south-western course to the Rio Grande River at the southeast corner of Presidio County. This line is conceded by all well-informed cattle-raisers to be an absolutely safe one, as indicating that the territory west and north of it is absolutely free from infection. At the same time cattlemen of experience allege that a considerable portion of the territory south and east of said line is as free from infection as the territory west of the line.

Owing to the large extent of territory embraced in what might be termed the doubtful district, and the meager railway facilities throughout this district, I have been unable to make such thorough investigation of the facts bearing upon the establishment of an absolutely correct line as to justify me in giving an opinion as to where the line should finally be established to separate the non-infected from the infected district. I would, however, respectfully submit the following statements from Texas cattlemen bearing on this subject, given to me in response to the following circular issued by you on the subject:

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., February 13, 1888.

To the owners of Texas cattle :

My attention has been directed to the fact that the recent settlement of a large portion of the country over which Texas cattle were formerly driven to northern markets has placed such obstacles in the way of this movement as to cause the larger portion of such cattle to be shipped by rail. The authorities of the various States and Territories having prohibited the unrestricted introduction of cattle shipped wholly or in part by rail on account of the alleged danger from splenic fever, it is important to determine the part of Texas from which cattle can be safely shipped to northern ranges. In order to secure complete and reliable information as to the limits of this district, I hereby request the cattlemen of the following-named counties to send answers to the questions hereto appended, directed to the Agent of the Bureau of Animal Industry, Fort Worth, Tex.:

Counties of Archer, Bandera, Bell, Bexar, Blanco, Brown, Burnett, Callahan, Clay, Coleman, Comal, Comanche, Concho, Coryell, Crockett, Dimmit, Eastland, Edwards, Erath, Frio, Gillespie, Hamilton, Hays, Hood, Jack, Kendall, Kerr, Kimble, Kinney, Lampasas, La Salle, Llano, McCulloch, Mason, Maverick, Medina, Menard, Mitchell, Nolan, Palo Pinto, Parker, Runnels, San Saba, Shackelford, Somervell, Stevens, Taylor, Throckmorton, Tom Green, Travis, Uvalde, Wichita, Williamson, Young, Zavalla.

1. Have you purchased any bulls or other cattle, or do you know of any that have been brought from north of the south line of Kansas, to your vicinity, or to any part of the counties named above? If so, state the number, the location as near as possible to which they were taken, and the number, if any, which died of acclimation fever.

2. Do you know of any cases in which cattle from the eastern counties of Texas have been taken to the counties named above in the spring or summer months and allowed to pasture on the same ranges with the cattle native to those counties? If so, state whether any disease occurred among the native cattle, and give symptoms and number affected, as far as possible.

If the cattlemen of the counties mentioned unite in securing this information at once, it is hoped that it will be the means of securing such modifications of present restrictions on the movement of cattle that have been transported by rail as will promote commerce in Texas cattle without endangering the health of the native cattle of the North.

I would ask parties who have heretofore furnished the Bureau with information on this subject to give such additional statements of facts as may be in their possession.

Very respectfully,

NORMAN J. COLMAN,
Commissioner of Agriculture.

STATEMENTS OF TEXAS CATTLEMEN.

The following letters and statements have been received in response to the foregoing circular letter:

Mr. J. H. Parramore, Abilene, Taylor County:

In reply to your questions I have this to say: That I have been ranching in Runnels County since 1879. I bought one Hereford bull in the spring of 1886 that was just shipped into this county from Kansas. He did well and is doing well now. On my ranch in Runnels County I have heard of some persons losing bulls, but don't know how many. I don't know of any case where eastern cattle gave our cattle any disease.

Mr. A. Mansfield, Bandera, Bandera County:

In reply to your questions I would say that I shipped 2 bulls and 1 calf from Washington, Pa., during the latter part of August, 1880, and Mr. J. B. Davenport shipped 1 bull at the same time. Out of the 4 head one died—the calf in December, though it was very poor when shipped. It was about four months old. The bulls are living. Mr. J. B. McElroy shipped 3 head in September, 1 bull and 2 cows. The cows are still living. The bull died in 1883. Mr. James Davenport shipped in this winter from Tennessee 3 head, and they have all died. He says they died of Spanish fever. In the summer of 1886 a lot of cattle was shipped in from near Bee County, and turned loose on the range with the native cattle, and none of them were ever affected with any disease. There is a disease prevalent in the southern part of this county called the stiff disease. The cattle become stiff in the hind legs so they can hardly walk.

Mr. M. E. Barnard, San Antonio, Bexar County:

Your circular letter of the 13th ultimo, addressed "to the owners of Texas cattle," was received this morning. In answer to question No. 1, I have to say that the Nueces Land and Cattle Company of San Antonio, of which I am president, has, during the last year, purchased 22 Polled Angus bulls and 48 Polled Angus heifer calves and yearlings, and shipped them to Zavalla County, Texas. These cattle were shipped from Kansas and were bred there. In acclimation 5 bulls and 3 heifers died. These cattle were fed upon sorghum and Johnson-grass hay, well cured and bright, and were allowed to graze upon a good green pasture at will. They were also fed bran and grain. They were all housed. About 20 of them were taken sick within fourteen days after their arrival. The methods of treatment and feed before starting were recommended by a veterinarian, who remained in charge most of the time. Four of them died in one night, when their feed was changed to prickly pear, chopped, and one pound of cotton-seed meal to the animal. From the commencement of the last method of feeding the sick ones grew better and recovered, and none of the others have sickened. Although several months have passed all of them flourish and have fattened and are active and well. I know of several other persons who have transported thoroughbred Polled Angus cattle from Kansas, Missouri, and Illinois into Bexar County. Some were five and six years old, many younger. Those who have fed them nothing but prickly pear and cotton-seed meal have not lost an animal. Others who have fed them upon dry feed have lost from 20 to 40 per cent. Mr. Ben T. Cable, Mr. J. P. Devine, and Mr. Ed. Polk are among the persons who have imported these cattle, and all live at San Antonio, in Bexar County.

In answer to your second question I can only say that from my own knowledge I do not know of any persons or companies who have purchased and brought any cattle from eastern counties in Texas to any of the counties named in your circular letter, and therefore can not give further answer to your second question.

You know that the prickly pear is indigenous to the soil of western Texas, and cotton-seed meal is a well-known article of commerce. It is my opinion that thoroughbred cattle imported from any of the Northern States will become acclimated without serious loss, provided they are sheltered for a few months and fed entirely upon prickly pear and cotton-seed meal, not exceeding one pound of meal per day to the animal, and all the prickly pear they will eat.

Mr. Geo. H. Adams, Brownwood, Brown County:

I don't know of any bulls having been shipped to this section from the section named. I have known of cattle being driven to this section from the east and permitted to range with the stock here, but no disease was contracted or developed in either, but both thrived alike.

Mr. John Bryan, Burnet, Burnet County:

In answer to yours of February 13, I can say that 1 Jersey bull was brought to this county from Missouri two years ago, and up to last October was all right—had no fever. I have known several small herds of cattle driven from the eastern counties where no disease whatever occurred from their importation. There have been two small herds driven to my ranch, and I know that they did not cause any disease.

Mr. L. Hearn, Belle Plain, Callahan County:

In accordance with your request, I will try to give you as near as possible my experience in shipping northern cattle into this and adjoining counties. I shipped 96 head of Hereford and Shorthorns to my ranch in Coleman and Concho Counties. I turned them in my pasture with cattle raised here. They did very well through the summer. I did not commence feeding until late winter and they got very poor. I lost some 10 or 15 of them, but saw no effect that they produced on my native cattle. I shipped these bulls from Chicago, Ill. I had a very good crop of calves from them the second year. I also have some 25 head, consisting of Herefords, Shorthorns, and Polled Angus at my ranch in Callahan County, consisting of bulls and heifers. All have done well except 3 heifers, which died the second fall. I take the disease to be dry murrain. They run with my native cattle in the same pasture. My cattle were all healthy—saw no signs of sickness among them. These cattle were shipped from near St. Louis, Mo. I have also handled cattle from eastern counties in Texas (in the spring and summer), and have never witnessed any trouble. They never affected my cattle in the least, nor did they seem to be affected in any way.

Mr. B. F. Reynolds, Griffin, Cherokee County:

In the summer and fall of 1875 I drove about 200 head of improved cattle from Colorado to this county by way of the place where Mobeetie now is, and I will say that they commenced to die of some kind of fever on the Washita River 15 miles north of Mobeetie. We camped for the winter 12 miles southwest of Mobeetie, and arrived here about March 1, 1876, as well as I remember. We had lost about 15 head when winter set in. When the weather got hot in 1876, after we arrived here, they commenced to die, with the same symptoms they had in the fall before, north of Mobeetie. They continued to die for eighteen months after getting here, and the last hoof of them had the disease, even the calves that were dropped after getting here, but carried by their mothers on the road down. Just how many we lost I don't remember, but figure that we lost about half that got here. It was not over that, and it was near if not quite that heavy. This is the only direct financial experience that I have had with importing cattle from the north, as I have considered it too risky. I have known of several different lots of fine cattle being imported into this immediate vicinity. The different times and numbers lost and numbers brought would be too numerous to mention. But they all have the disease sooner or later, and they are not safe until after eighteen months' residence in this country. The per cent. of loss varies. It generally runs from 25 to 50 per cent., and oftener over 50 than under 25 per cent. This is especially the case with fine cattle, regardless of sex. The finer the blood the greater per cent. of loss always. I have known of a great many cattle coming from all parts of Texas, and don't know of a single instance of the cattle here being affected by coming in contact with them. I am reliably informed that the Monroe Cattle Company have lost cattle for the last three years in one of their pastures, and not in the other three pastures that they own, and the pasture that the cattle die in has a public road running through it, and the others have not. They claim that it is eastern cattle passing through that causes the cattle to die, but this is the only instance that I have ever heard of. The main trail passes through this county about the center, and there has been over a million cattle passed over it, and I never heard of one of the native cattle being affected, and the cattle that have passed over this trail come from all over southeast, south, and southwest Texas. I lived in Colorado several years, and have known of numerous herds of Texas cattle being turned right among the natives of that country, and I not only never saw, but never heard of a single cow dying of Texas fever or any fever, and I was in the cattle business and out among them personally, and would have known if there had been many died; but the cattle that I speak of were all driven and none shipped. With twenty years of actual experience in working with Texas cattle, and covering almost all of the range country from the Rio Grande to the British possessions, I would make oath to the effect that I never saw a single cow affected, or never heard of one dying anywhere near me in any place that I have been, except in the herd of the Monroe Cattle Company referred to above. But cattle brought from north of the south line of Kansas to this country are just as certain of having the fever as that they are brought here, though sometimes it is in a mild form, and they are liable to have it and get well without attracting notice. * * *

Since my letter of March 7 I have been thinking the matter over, and have come to the conclusion that I left out some very important facts. Our cattle commenced to die 15 miles north of Mobeetie, but they had not come in contact with any other cattle, either native or southern, after leaving the Arkansas River, which shows conclusively that it was the change in climate from Kit Carson, Colo., to the Washita River, where the first ones died, and of course they must have contracted the disease a little north of that, as they commenced to die there, and we did not lay over there any length of time. In 1875, the year I came down, there were no cattle after leaving Bugbee's ranch, at Laken, and we saw no sign of any cattle. Another fact is that fine cattle brought here from the north and mixed with the natives of this country will often live eighteen months and then die, which fact I think proves conclusively that the disease is not contracted from the cattle in this country. The cattle that I brought here that died, and were sick probably one or two at a time all the summer after getting here, when winter came again I thought they would be safe, but quite a number died the next summer. Now, it looks as if cattle taken from this part of the country north would disease those up there, and to bring those same cattle down here and put them in the same pens and on the same range would certainly disease those here; but that they will not can be abundantly proven.

Mr. H. D. Taylor, Henrietta, Clay County:

In answer to the second question asked, I will say that in July, 1886, we shipped 200 head of cattle from Fort Worth that were gathered in Collin, Grayson, Hunt, Rockwall, Kaufman, Dallas, Ellis, and Hill Counties; also later in the month we shipped 500 head that were gathered in Bosque, Johnson, and Tarrant Counties, and in July and December, 1887, we shipped from same counties and located them here in Clay County with other native cattle of the county, and I have seen no indications of any sickness among the native animals.

Mr. W. H. Worsham, Henrietta, Clay County:

In answer to the first question in your circular letter of the 13th ultimo, I would say: I have purchased bulls in Pike County, Mo., and brought them here where a number have died. I have known of others being brought here from Missouri with the same result. I purchased about 70 head and brought them to this county and about 25 died. Have known of other bunches being brought here from Missouri without any death loss. To the second question I would say: I have known cattle brought to this county from eastern Texas in the spring and summer months and placed on the same range with cattle native to this county, and frequently as many as 5 to 10 per cent. of the native cattle would become affected with fever and die. Have also known cattle driven from this section to Kansas and die with fever there. I consider all cattle west of the Upper Cross Timbers and south as far as the Texas and Pacific Railroad safe from fever when shipped. Do not consider cattle in the timber as good cattle, nor as healthy as those on prairie.

Mr. W. B. Doss, Manager Day Cattle Company, Coleman, Coleman County:

I herewith inclose a map marked with reference to the quarantine line, beginning at the northeast corner of Clay County (on Red River), taking in the counties of Clay and Archer, thence running south to Mason, thence west to the southwest corner of McCulloch, thence southwest to the mouth of the Pecos River. This embraces a high, rolling, prairie country, interspersed with mesquite timber. Have handled cattle from McCulloch, Concho, Menard, Tom Green, Runnels, and Coleman Counties. Have driven them north as far as Wyoming Territory and have never known of them imparting Texas or splenic fever to other cattle. I consider this territory perfectly safe. The altitude of Coleman County is 1,750 feet. The country east of this line is known as the Cross Timbers. If there is any further information you may desire and will let me know I will do all in my power to furnish you with the same.

Mr. W. C. Dibrell, Coleman, Coleman County:

Hon. Norman J. Colman's circular of the 13th ultimo was handed me by our postmaster a few days since. In answering the first question I have to say: I purchased last fall from Mr. William Powell, of Beecher, Ill., at the Dallas State fair, 4 head of registered Hereford cattle, 2 of each sex, brought them to this county by railroad, placed them on my ranch at Old Camp Colorado, 12 miles northeast of this town. Have been feeding in the same pasture with them some 30 or 40 poor native stock. Up to the present date they (Herefords) have shown no sickness of any kind; eat heartily, have grown rapidly, and to-day are "rollicky" and in fine condition. In my pasture I have good natural protection, *i. e.*, brush and hills, also a

comfortable shed — southern exposure. During the blizzard of December and January the Herefords remained under the shed, but ordinarily northern preferred the brush (live-oak and “shinery”). Col. R. H. Overall, of our county (now absent), two years ago purchased some 35 or 40 head of graded Herefords, I think in Missouri; shipped them to his ranch in this county, and has lost but few, if any. He turned them loose on his range (pasture 30,000 acres), and fed them during winter on sorghum. His purchase was yearlings; mine calves eight to twelve months old. Some few hornless cattle, Galways and Polled Angus, have been successfully introduced and raised in the county. Shorthorns introduced before the completion of our railroad did not do well; losses were very heavy, which were attributed to the long drives necessary to reach us. A great many cattle from eastern Texas have been brought into this county. Our native cattle have contracted no disease from them, and they have invariably improved on our range, acquiring flesh fast and their issue increased in size. I have never believed any disease, such as “Texas fever” or “splenic fever,” originated in cattle north of latitude 31, and have some doubts as to its existence north of 30°. Our winters are cold enough to kill out any such disease. We have no marshes, swamps, or stagnant water, and the only disease among our cattle to amount to anything has been poverty caused by overstocked ranges.

Mr. A. S. Brown, Coleman, Coleman County:

In reply to your circular letter I will say that Mr. R. R. Bowen, Coleman City, bought 3 grade Durhams less than one year old, shipped here from southwest Missouri, and has lost none. Mr. C. A. Childs, of this county, bought 17 from the same herd, and has lost 1 from fever. They were shipped to this point in the winter of 1886-'87. A good many cattle have been shipped from eastern Texas to this county. Any deaths that have occurred among these cattle was the result of starvation. Indeed, fever in cattle shipped from any part of Texas to this county is unknown.

Mr. E. Q. Kriegner, Spring Branch, Comal County:

In reply to circular dated February 13, 1888, “to the owners of Texas cattle,” I state to you as follows: William Prutchett, of Frankford, Pike County, Mo., brought to this section, in 1879, 25 cows and 12 one year old bulls. All of the cows died within a few weeks of acclimation fever. Three of the bulls took the disease but recovered; 2 of the last 3 bulls are still alive. The balance of the bulls died also in a short time after their arrival. The stock was imported during the winter months.

To question 2 I have to answer that I don't know of any cattle which were brought from eastern counties of the State to this section. There is no fever or any other disease amongst cattle in this section.

Mr. P. R. Clarke, Comanche, Comanche County:

I bought 1 bull in the spring of 1887 from a party in Fort Worth; shipped him to my ranch in Comanche County. He did well; has had no fever. This winter I bought 7 head pure-bred Herefords. Three took the fever; 2 died; 4 have not been sick to date. The 3 that took sick were raised by Davis, Whitney & Co., of Pittsfield, Ohio. I bought 4 of William Powell, of Beecher, Will County, Ill., none of which have been sick. My neighbor has lost 2 out of 5; he bought of same party from whom I purchased mine. I live on the cattle trail from the south, which is now closed. My cattle are more healthy since the drive over my range has stopped; there was no marked disease though. In winter they died considerably; they got weak in their loins, passing from the bowels quantities of yellow mucus. On taking off their hides I found in many cases large patches of yellow and bloody mucus, especially on their legs. Frequently the throat was found badly swollen. Now, while I have lost cattle from poverty, I know that poverty was not the cause of such severe losses as I have sustained. My loss the two winters past has not been more than 2 or 3 per cent. Prior to that time from 20 to 30, and once as high as 50 per cent.

Mr. G. A. Beeman, Comanche, Comanche County:

In reply to your circular of February 13, I inclose statements from T. J. Holmsly and H. R. Martin, two of our oldest and most extensive stockmen. I can only add my testimony to theirs. Having transacted business in cattle for a number of years, in all my driving to the Pan Handle and west I have never known our cattle to affect cattle there. I have also known a number of cases where our cattle contracted the splenic fever by coming in contact with cattle from more southern counties. Feeling that this section justly deserves to be exempt from the operations of the quarantine laws, I trust you may be able to thoroughly establish the fact.

Mr. H. R. Martin, Comanche, Comanche County:

In answer to the first question contained in your circular of February 13, I would state as follows: About the 1st of March, 1875, I received 12 head of Shorthorn cattle, which were calved in Clay County, Mo. These cattle arrived at Dallas March 1, and were driven out here and arrived about April 1. About the latter part of April a herd of southern cattle passed through the range where these bulls were, and 4 of them contracted the splenic fever and died. The others have done well, and I still have some of them on hand. I have known several lots of northern cattle shipped to this section, and all of them have done well excepting in two or three instances, and those exceptions have invariably resulted from their coming in contact with cattle from counties farther south. I have driven a good many cattle from here to the Pan Handle and to New Mexico, and have never known the native cattle there to be affected by the cattle from here. Have had cattle there for years, and have driven my stock from here there, and have never felt any uneasiness as to their affecting my cattle there. In answer to question No. 2, I have known of instances where our cattle were affected by southern or eastern cattle.

Mr. T. J. Holmsly, Comanche, Comanche County:

In answer to the first question in your circular of February 13, I would say I brought from Moberly, Mo., 10 head of Galloway cattle. They were shipped by railroad 15 miles from here, and driven from there to this place. Have had the cattle for three months and they are all in fine condition. In 1880 I shipped from Emporia, Kans., 35 head Shorthorns. These cattle were shipped to Fort Worth, 100 miles from this place, and in driving here we came about 60 miles over the trail of southern cattle. About 8 head of the above herd have since died from what I suppose to be Spanish fever. I attribute their death altogether to having been driven over the trail where southern cattle had passed. I know of several bunches of northern cattle which have been shipped here in the last few years, and none have died from the fever. I would further state that I have driven cattle for points to north for the past eight years. We strike the regular southern trail about 40 miles from this point, and more or less of our cattle invariably die from coming in contact with this trail. In answer to the second question, I don't know of any instance where southern cattle were brought and located in this county; but, as above stated, the main southern trail lies west of this county, and whenever our cattle are driven on that trail or mix with southern herds more or less of our cattle die of the fever.

Mr. A. B. Robertson, Colorado, Nolan County:

In answer to your questions relative to the importations of northern cattle in this section, I will say that I have been handling large herds of cattle in Nolan and Runnels Counties, in which nothing but Shorthorn bulls were used. One lot of about 60 or 70 bulls were purchased by a Mr. R. K. Wylie, in Missouri, and shipped to Runnels County. I was manager of the ranch there. He lost about 3 per cent. in acclimating. Very few will die out of a shipment when they are at once tamed on good grass. I purchased about 20 head of Shorthorn and Hereford bulls, shipped in here from Illinois, turned them in my pasture immediately on arrival here, and did not lose one. The losses that have occurred in most instances, in my judgment, can be attributed to ignorance in handling, or carelessness. If cattle were shipped instead of being driven from the south or east it is probable that they would affect the cattle of this section. Of my own knowledge I can say that I know of cattle that have been shipped and driven from the counties named to the Territory and north without affecting the cattle of that section. Mr. W. Scott, president of the First National Bank at Colorado, Tex., purchased about \$10,000 worth of Hereford and Shorthorn bulls; shipped them from Missouri, Indiana, and Illinois—about 200 head in all—to his ranch in Tom Green County, and I am reliably informed that he did not lose more than 5 bulls. Himself, his men, and his neighbors are my informants.

Mr. T. C. Hunt, Ranger, Eastland County:

In answer to inquiry concerning the importation of northern bulls to our ranges, and the exportation of our native cattle to northern ranges, I will say that there have been several herds of young steers driven from Eastland and adjoining counties to Colorado and Nebraska. Mr. Paysley, of Colorado, bought cattle several years ago in succession without any complaint of fever or other acclimation diseases. The best evidence is that men will come to the same section for their cattle for a number of years straight along. We think our cattle perfectly safe to ship on to northern ranges, as they are well bred. We have had as many as two car-loads of bulls shipped to our station at one time from Columbia, Mo., and turned loose with our

range cattle without the loss of a single animal. Besides, others have shipped here with good results, and we think that steers can be shipped on northern ranges with the same result by good handling.

Mr. O. G. Hugo, Dilley, Frio County:

In regard to questions asked I would say that I have not bought any northern or eastern cattle, and that I know only a few in this and La Salle Counties that have been brought from northern States, and that there has been no mortality among them as far as I have been able to learn, only in one case a very light loss, and that was attributed to improper treatment. Our cattle are always healthy, and northern cattle do well when brought here and turned loose upon our ranges. It does not affect them in the least. The same can be said of cattle brought here from eastern counties.

Mr. R. B. Coleman, Pearsall, Frio County:

In answer to your circular in regard to cattle shipped to this county from the eastern counties of this State, I will say that I have lived here about 6 years and have shipped about 400 head of cattle into this county from eastern Texas. There has been no acclimation fever among them at any time, and no cattle have been infected by them by turning on the range together. There have been a great many cattle shipped to this county from Mississippi, Louisiana, and eastern Texas during the last 6 years, but there has been no infectious disease among them at any time.

Mr. John Griffith, Junction City, Kimble County:

There have been 30 head of bulls brought to this county. Have all done well; none have died from acclimation. There have been several herds brought here from eastern Texas. They have invariably done well; no sign of disease among them or native cattle on the same range.

Mr. H. E. Chesley, Shive, Hamilton County:

In reply to your circular of February 13, we would say that we have never purchased any bulls that have been brought from north of the south line of Kansas, nor do we know of any one who has. Have known cattle brought from eastern Texas and placed on the range in some of the counties named in your circular (Blanco and Hamilton). Don't know that any disease occurred among the native cattle on the same range.

Mr. J. C. Loving, Jacksborough, Jack County:

In answer to first question by the Commissioner of Agriculture, I would state that I have never owned but 3 bulls that came from north of the line mentioned. They were Shorthorns. In acclimating one of them was sick but recovered. In answer to second question, I have known eastern Texas cattle driven in here and into Young County and grazed in spring and summer with native cattle and no disease appeared among them.

Mr. F. H. Kingsbury, Boerne, Kendall County:

In reply to your questions in regard to cattle shipped into this and several other counties, I beg to state that no less than 40 head of bulls have been shipped into this county one and one-half years old. Two hundred head have escaped from drives from the lower counties, bound for Kansas. One thousand head have been brought into this county for pasturage from the lower and eastern counties. I have never seen or heard of a single animal dying of acclimation fever.

Mr. E. A. Steel, Kerrville, Kerr County:

I can answer your second question. Cattle driven in here from the eastern counties have done well. No sickness has occurred. Bulls imported from Kansas have also done well. No native cattle have been infected by the cattle imported from any other county or State. Bulls that come from Kansas by railroad generally do well.

Mr. H. T. Hill, Lampasas, Lampasas County:

In the spring of 1886 I bought 11 head of Hereford yearlings that were shipped direct from Missouri. I put them in my pasture along with my natives, and they all had what we term Texas fever; I lost 3 head. I have known of eastern cattle being brought to this county, but never knew of any disease among the native cattle by being brought in contact with them.

Mr. W. P. Lockhart, Mason, Mason County:

In December, 1874, we brought 21 Shorthorn bull calves into this county from Kansas City, Mo. We kept them in a pasture until they were two years old past,

and then turned them on the open range here with 400 Texas cows. They did well, and now we have over 2,000 of their stock. Last year the last one of the original number of bulls died at the age of fourteen years. We have known cattle to be brought into this county from the eastern counties of Texas in the summer months and allowed to graze with our native cattle without loss or sickness of any kind.

Mr. W. E. Wheeler, Mason, Mason County:

I have had bulls that were brought from north of the south line of Kansas, and none of them died from disease. My ranch is situated in Mason County, Tex., about 20 miles northwest from the town of Mason. About three years since a gentleman moved a herd of cattle through my range, and immediately afterwards I had 75 calves to die. His cattle were brought from Bob. Stafford's, near the coast of southern Texas. They were very poor and exhausted from travel. This occurred about the latter part of August or 1st of September. After the first rain my calves ceased dying.

Mr. A. W. Dunn, Colorado, Mitchell County:

In November, 1886, I bought of Gregory, Cooley & Co., of Chicago, 65 Hereford bulls. I have held them since that time in Howard and Midland Counties. I have lost but 4, and 1 of these got out of the pasture and perished for water. Some of them were not more than five months old, and as I fed them but little they got very poor, and may have died of poverty. My native cattle were not affected by them.

Mr. H. W. McKay, Colorado, Mitchell County:

Noticing the circular of Commissioner Colman, I would state that I have been ranching in Tom Green County for the last four years. Have purchased a good many northern bulls and have met with small loss from acclimation. Purchased last year 150 head of grade Herefords, delivered to me at this point May 1, 1887. These were mostly raised in Kansas. I have lost but 20 head of them. The balance are in fine condition now, much better than the range cattle. Know nothing of eastern or southern cattle being moved into this county.

Mr. John Harris, Colorado, Mitchell County:

In answer to circular of Norman J. Colman in News of 24th instant, I would say that I have known of a great many bulls being shipped from Indiana, Illinois, and other States to this county (Mitchell). Generally a few will die from change of climate, possibly 5 per cent. of a shipment, but where proper feed and attention is given them they rarely die, and after a short time will do well on the range with the native cattle. I have known a great many cattle driven in from south and east Texas, and they do not affect the native cattle here. I have also known of cattle driven from this county to New Mexico and Colorado without any disease appearing in the cattle native to those States. I firmly believe that at this elevation (2,000 feet) cattle are perfectly safe to go anywhere.

Mr. M. O. Lynn, Palo Pinto, Palo Pinto County:

In answer to your questions I will say, first, that I bought about 35 bulls north of the south line of Kansas. These cattle were from Missouri and Kansas. I lost about one-third of them from what is known as acclimation fever; said bulls were kept in Palo Pinto County. I never have bought and turned loose on the range in said county any cattle east of the counties you named, but have driven quite a number from Palo Pinto and adjoining counties to Kansas, Colorado, and Indian Territory, and have found them perfectly healthy, and I think them perfectly safe from disease when shipped to the Northern markets.

Mr. Giles M. Rowntree, Richland Springs, San Saba County:

Your circular of the 13th ultimo was handed me this evening. In answer I will say no bulls or cattle of any kind have been brought to this section in the last twelve months. There have been no diseases among cattle for several years, and especially nothing of a contagious nature.

Mr. A. D. Robbins, San Saba County:

In answer to the questions you ask I will say that I never have purchased any cattle from the north of the south line of Kansas, but there have been a good many others who have brought them to San Saba County, and there have been a great many eastern cattle driven and located in this county, but I have been in the cow business for twenty years and have never heard of splenic fever in the county. Cattle in this county never have any disease. Calves die here sometimes with what is called black leg. Old cattle never have any disease whatever; only die with poverty or old age.

Mr. G. E. Waters, Albany, Shackelford County:

As I have been devoting part of my time to raising of fine Hereford cattle on my ranch in Shackelford County, I thought it might be right for me to answer the letter of Commissioner Colman regarding cattle brought here from northern States. From 1881 up to date I have shipped in 117 head of cattle as follows: In December, 1881, I landed a car of Missouri cattle, mostly bulls, 23 in all. I kept them on my ranch until May of 1882, when, owing to drought, I moved them to Tom Green County, southwest of here. In doing so I had to cross and travel awhile on the route over which cattle from southern Texas had that year passed. Nearly all of my cattle were sick, and I lost 9 head. Balance got all right and lived. In November, 1883, I shipped 24 head from Ohio. They were unloaded at Cairo, Ill., and Texarkana, Tex., in same pens where Texas cattle were held. As there had been but light frost I lost 7 head out of this lot. They began dying one week from time I got them home, and all died within a short time thereafter. Since then I have lost none of them with this disease. I put this car-load on a fresh pasture where no other cattle had been since June. In 1885 I shipped in 37 more from Ohio. That year I waited until late in November, until after a very big frost and cold spell, and had better success, although I had to use the common pens along the route. Of this lot I only lost 2 head, and am confident one of them was killed by medicine given to move his bowels. I gave him, besides other things, a very large dose of croton oil, and just before it acted, as it was some time, I gave him another big dose, and it was too much for him. In the early part of February, 1888, I received 33 head, and they are all fine and healthy. They came from Missouri. All the deaths I have reported were caused by what is known as Texas fever—drooping ears, weak loins, sunken eyes, stiffness, and fever. I turn my cattle in when I receive them (except the lot in 1883) with my native cattle. All these shipments were high grade or registered thoroughbred Herefords, and I have some very fine cattle from them now.

Mr. P. A. Graham, Albany, Shackelford County:

Replying to your circular of February 13, I will state that I have lived in this county for twelve years, and in the adjoining county of Stephens five years, and have noticed the effect the cattle driven through here have had on native cattle. Living as I have on the route used by through cattle, I have had good opportunities to observe the same. It is a well-known fact that cattle along this trail, over which cattle from south and east are driven, die more or less every year, and the cattle that die are always in good fix and to all appearances healthy, and I believe they die in a very few days after becoming affected. They have the drooping ears, stiffness in limbs, weak loins, sunken eyes, and fever, which is called Texas or splenic fever. It is part of my work to hunt over the adjoining country for my scattering cattle, and in all my rounds I have never noticed an animal away from the cattle trails that had this disease. I have never known an animal to die with this fever before the passing of these trail herds in the spring, but always after these herds come along. I am satisfied native cattle kept from contact with through cattle from south and east do not have this fever, but when they come in contact with them more or less are affected and die. About five years ago Cochran shipped from Illinois some 60 grade and thoroughbred bulls, locating them near southern line of this county. I bought of this lot 1 bull and kept him off the trail. He is alive and a fine animal to-day. Others living on the trail bought bulls out of this lot, and not thinking or believing any danger to them from the trail herds allowed them to come in contact, lost heavily, as did Mr. Cochran, who kept some of the lot for use in his own herd. The five years I lived near the line of this county, and before any trail passed through this section, or any incoming of cattle from south or east occurred, such a thing as ticks or lice on our cattle or diseased cattle was unknown among our herds, and I know that I am right in asserting that it is dangerous to our herds to have southern and eastern cattle driven through or herded in their range.

Mr. J. A. Matthews, Albany, Shackelford County:

In reference to acclimating bulls north of the south line of Kansas, I will say that I bought 4 thoroughbred Shorthorn bulls in Missouri and had them shipped to this county in November, 1886. During the following winter 1 died. The bull became a little unwell and was filled full with different kinds of medicines, which I considered at the time and do yet the cause of the animal's death. The other 3 bulls were never sick that I know of, and are living now. Never used any preventive whatever. The bulls were turned loose with the range cattle soon after they arrived here. In reference to cattle from eastern counties communicating disease, I would say that no such cases have come under my observation, but I have heard of cases not far from me where roads run through pastures and herds of eastern cattle

have been driven along them and grazed and afterwards the native cattle have died. I have given it as my opinion that the disease was what is now known as splenic fever, as the symptoms were similar to those in Kansas and Colorado. My ranch is in Throckmorton County, and of course this report is what I have seen and heard in this county.

Messrs. T. C. Sterrett & Sons, Albany, Shackelford County:

In reply to question No. 2 I will state that last August we purchased and put in our pasture 2,412 cattle from 150 miles southeast. We had put in 40 head of native improved cattle, bred within 7 miles of the pasture—all bulls for service in herd. But out of the number 9 died with all the symptoms of Texas or splenic fever. The pasture is on the highlands, 700 feet above prairie, and in southwestern part of Shackelford County.

Mr. G. T. Reynolds, Albany, Shackelford County:

In answer to your late inquiry regarding Texas fever in this part of the State I beg to say that I have resided on the cattle trail from south to north since the beginning of the cattle drive up to the present time, and have carefully noted the results of the mixing of the southeast and southern raised cattle with our native cattle. There have always been some losses each year of native cattle along the line followed by through cattle from the south and southeast. This loss generally commenced in July or August, and until September or later our cattle would die with what we always thought was murrain. Being native Texans we were not willing to admit or even consider the disease to be Texas fever caught from southern cattle. But in late years, since large pastures came into use, I have had a fair, impartial test of the matter. I was one of the first to go into the pastures as manager of the Monroe Cattle Company; fenced a large pasture in this county. In the spring of 1883 the pasture was divided into four equal parts, of about 30,000 acres each. The main traveled road, or the old cattle trail from the southeast to the northwest, runs through one of these pastures and only touches this one. This being a thoroughfare for traveling herds, we stocked it heavily in the summer in order to get the good of our grass, but mark the result: The first year after subdividing the pasture, in 1884, we had the pasture through which the road runs stocked with a good grade of northwest Texas cattle, and about August they began to die. During August and September about 50 died. Being skeptic on the question of fever we were still unwilling to charge the cause to the trail cattle, so we passed on to 1885, and in August cattle died as before and in the same manner. We then concluded the cause to be an old sheep-dipping vat in the pasture that had been used years ago and at which the cattle licked at on account of the saltpeter and sulphur there. As we suspected this of poisoning them we burned the place, filling all the holes and burning over the ground and also burning every stick of timber. All this time there was no loss in adjoining pastures belonging to the same company. In 1886 we leased or took in 1,000 beeves for Messrs. Hassard & Stephens, and the results followed as in the two previous years, as Messrs. Hassard & Stephens can testify, as they lost heavily on their beeves. This being the very dry year we were still unwilling to attribute the cause to the trail. Last year, 1887, the same result. More dead cattle in the same fatal pasture, and none elsewhere, though the fences join.

I have seen many cattle die with Texas or splenic fever, and the cattle we lost all had the same symptoms, such as drooping ears, sunken eyes, weakness of the loins, and all died in from one to four days. They always had a very hot fever. Cattle from all parts of the southeast and east traveled through this pasture, including cattle from Alabama and Florida. We are now thoroughly satisfied that the trail was the cause of our heavy losses, and we shall use this pasture in the future during the winter only.

These facts, with many others that could be proven, clearly show that cattle in this vicinity are subject to the Texas fever when they come in contact with cattle from the south and east, but are never troubled with it when they are kept clear of such herds in transit.

We have also had many herds of beef cattle driven to Caldwell, Kans., and last year (1887) had several beeves die with this fever after crossing the trail about Red River; some of them died after reaching the Kansas line.

It is beyond question that this county is clearly above the fever-producing line, and should have all the sanitary protection of other localities. Throckmorton County, north of this, has an altitude on an average of 1,800 feet above sea-level. This county (Shackelford) is 2,000 on the west and 1,600 on the east side, and just east of the one hundredth meridian and between the thirty-second and thirty-third parallel of latitude.

Mr. J. C. Dodson, Albany, Shackelford County:

I have in hand a circular of Commissioner Colman, dated February 13, 1887, regarding splenic or Texas fever, and in reply will say I have lived near and on the trail, in this (Shackelford) county, over which cattle from the coast are driven, and have noticed how native cattle are affected. I have for the past three years been interested in several pastures, and now have cattle in two pastures through which the trail runs, and have cattle in two pastures a good distance away from the trail. Every year, just after the herds begin passing, the cattle in the two pastures commence dying, and we have lost quite a number in these two trail pastures every year, but in the pastures that are away from the trail I have never known a single animal to die with the disease. I have traveled a great deal over the country after cattle that have strayed off, and I have never known of any cattle dying with similar disease as those that die on the trail, nor have I ever heard of such cases. It is generally considered among owners of herds in this section, and has long been so, that the eastern and coast cattle give our cattle this disease. This decision has been arrived at from the deaths along these cattle trails each successive year, especially when the cattle that were kept away from this trail remained healthy. It is our firm belief, after this experience, that these eastern and coast cattle are the cause of this disease, and that native cattle of Shackelford County are as healthy as cattle in any county I know of. I bought 3 Durham bulls about five years ago (in 1883), and have 2 of them yet. The other one disappeared very mysteriously. We were watching them pretty closely, and one day we missed this one from the place where we were keeping them. Thinking he was hurt or possibly sick we hunted everywhere, far and near, but never could find him or heard of him, and as we felt sure we would have found him if he had died (it being summer time) I have always believed he was stolen and driven off. He was the finest of the three. These bulls either come from Illinois or Missouri. I have 9 bulls now which I bought and shipped from Missouri, getting them here about the 1st of February. I turned them in with my native cattle and they are as fine and healthy as you please.

Mr. A. J. Jones, Breckenridge, Stephens County:

I bought 3 Durham bulls four years ago. They were shipped from Missouri, near Kansas City. Two of these bulls died of fever the first year, in the summer season. The third one lived until this winter, when it died. But he never did any good; was useless, in fact. I don't think they infected other cattle. If cattle driven from eastern counties into this infect native cattle I don't know it.

Statement of Mr. M. Harrold, Fort Worth, Tarrant County:

Mr. Harrold says that in 1882 he moved a herd of cattle from Buffalo Springs, Clay County, to Greer (?) County, and turned them on the range with acclimated, high-grade cattle. No splenic fever developed in consequence. He considers Clay, Palo Pinto, and Jack Counties safe. In the fall of 1881 he moved 35,000 cattle from Clay, Baylor, Archer, Jack, Young, Palo Pinto, and Throckmorton Counties to Tom Green. No rain from 8th of June to 12th September. No disease developed; water bad. Other parties drove in the next year cattle from same counties; no disease. Large numbers of native, high-grade Panhandle cattle drifted among these herds with no bad results. He says he would not hesitate to ship cattle from these counties to Colorado and turn them loose with native range cattle. His experience causes him to believe that it is a question of altitude. Splenic fever is like yellow fever among men, it never originates in high altitudes, hence is a local disease. The United States Bureau of Animal Industry is engaged in a most commendable work in trying to determine the line in Texas separating the infected from the non-infected districts.

Mr. E. P. Davis, Throckmorton, Throckmorton County:

In reference to imported cattle I would say that I have noticed that our cattle die in the summer months along the trail where those cattle are driven, and do not on any other part of our range. I can not account for this unless the disease is splenic fever. I sold Mr. Dave Grever, of Kansas, a lot of steers a few years since. The cattle were driven to south line of Kansas in July, and were grazed the balance of the season with a lot of native Kansas cattle. None of the Texas or Kansas cattle took the splenic fever.

Messrs. J. O. Wood & Sons, Fort Griffin, Throckmorton County:

We are in receipt of your letter of inquiry, and in reply will give you a few instances which, to our minds, are convincing proofs that our cattle (in this, Throckmorton, and adjoining counties) are free from splenic fever. We sold, a few years since, several hundred head of three and four year old steers to one Mr. D.

Grever, of near Medicine Lodge, Kans. Mr. Grever drove the cattle from this county in the month of July to near the south line of Kansas, put same in with other cattle there, a part of which were native Kansas cattle, grazed them together till fall, and there was not a case of splenic fever among any of them. Later—in the fall of 1885—we drove 800 head of steers to Hill County to feed for market, and there were several that were sick with every symptom of splenic fever. Again, in the fall of 1886, we drove 400 head to Hill County, and several were affected in the same way.

Mr. S. J. Blocker, San Angelo, Tom Green County:

I do not know of any bulls, or any other class of cattle, that have been brought to this part of the country from Kansas or any other northern locality. I have brought cattle from several of the named counties to Tom Green, and never have lost any from disease. Have put them in the same pasture with the native cattle. In 1886 I brought from Maverick County to this county 2,000 steers (yearlings), wintered them with the rest of my cattle, and drove them to Wyoming last spring, and I never saw healthier cattle in my life. Have been wintering steers here for three winters, and they all came from the southern counties.

Mr. William H. Jolly, manager of the Crescent H. Ranch, Wichita Falls, Wichita County:

There have been lots of bulls shipped into the adjoining counties from all parts of the Northern States, and as far as I know there have been no losses among them. There have been driven through our range, in Clay and Wichita Counties, in the past four years, thousands of head of cattle, from all parts of eastern and southern Texas, en route to Tom Green and other western counties and the Indian Territory, and we have never lost any of our native cattle from any disease from coming in contact with the trail cattle.

The foregoing letters and statements are the result of numerous and persistent applications to stockmen of Texas for information desired by the Department. I am in hopes that further investigation the present season will definitely settle this vexed question, so that the greatest freedom of movement for Texas cattle can be secured consistent with protection to northern cattle. When the line is officially determined upon by the Department, separating the infected portions from the non-infected portions of Texas, I am satisfied that it will be respected by the live-stock sanitary authorities of Northern States and Territories, and cattle from the non-infected districts will be permitted to be shipped north without restrictions other than satisfactory evidence that the cattle are either natives of the non-infected districts, or have been there over ninety days, which is admitted by all competent authorities to be ample time to purge them of all infection. There is a disposition on the part of some of the northern authorities to permit cattle from even the known infected districts to be shipped into their territories, provided they are kept separate and apart from native cattle en route by being fed and watered in pens provided for their special use, and unloaded directly into pastures provided for that purpose, from which all native cattle are excluded. It is generally conceded that the most profitable feature of the cattle business of the northern ranges is the maturing of southern steers, and the demands of commerce will, with intelligent direction, undoubtedly secure arrangements of the nature indicated which will afford a northern outlet for southern cattle from the infected districts without entailing any particular hardship. While the northern ranges are being rapidly encroached upon by settlers, at the same time the arid nature of the country will for all time preclude any other use of large areas of land except for grazing purposes, and if the breeding of cattle on northern ranges, which has generally been found unprofitable, is abandoned, the movement of southern steers to northern maturing fields will un-

doubtedly be continued, and in all likelihood increase to an extent equal in size to that of the year 1884. It is therefore important in the interest of cheap food, and in justice to the cattle interests of both sections, that such uniform live-stock sanitary regulations by all western authorities be secured as will give the greatest possible freedom to the movement of southern cattle consistent with safety to northern herds.

RESTRICTIONS ON TEXAS CATTLE.

The following quarantine regulations, placing restrictions upon the movements of Texas and southern cattle, are given for the information of the Department. It will be noted that the Dakota authorities absolutely refuse to receive cattle into that Territory from any portion of Texas unless driven all the way. This action amounts practically to a total prohibition against the entrance of Texas cattle into that Territory, for the reason that the difficulties in the way of the drive are so great as to almost preclude the movement by trail.

The action of the Dakota authorities is certainly unconstitutional. While it is admitted that Dakota has the right under its police powers to place such restrictions on the entrance into the Territory of cattle from such infected districts as experience has demonstrated are necessary to protect the health of her cattle, at the same time it is not tenable to arbitrarily stop the introduction of cattle simply because they are from Texas. Where restrictions are placed on the movement of cattle on a pretext of disease it tends to weaken the entire cause of protection, because it leads people who may have doubts of the necessity of restrictions to think that all restrictive measures are inaugurated for selfish and ulterior purposes. A notable instance in illustration of this came under my observation at the time of the outbreak of pleuro-pneumonia at Mandan, Dak. When I was in Montana, aiding in quarantining cattle that had been exposed to infection from the Mandan herd, I found considerable difficulty in securing quickly by wire the necessary data from railway and stock-yard management, owing, as freely alleged by Montana cattlemen, to the doubts existing in the minds of these officials as to the existence of the contagion and consequent danger. Montana stockmen expressed the regret at that time that during the previous year the authorities of that Territory had ordered all Texas cattle quarantined at the State line for ninety days, no matter from what part of the State the cattle originated. This order was afterwards revoked, but it was so clearly unnecessary and illegal that the owners of herds from Texas did not pay any attention to it, and the Montana authorities were afraid to attempt to enforce it. The following is the proclamation of the governor:

Quarantine proclamation.

TERRITORY OF MONTANA, GOVERNOR'S OFFICE,
Helena, May 11, 1888.

Whereas on the 20th day of May, 1886, and on the 28th day of April, 1887, and again on the 3d day of February, 1888, the governor of this Territory issued quarantine proclamations, by the terms and provisions of which all persons were forbidden and disallowed to introduce or bring into this Territory any cattle whatever from the State of Texas, except such as were traveled on foot all the way from that State to this said Territory, and that provision of said proclamation is now in full force:

And whereas written assurances and representations are now on file in this office that cattle raised (or that have been continuously ninety days) in that part of said

State of Texas called the Panhandle, to wit, all that part of the State situated north and west of a line drawn from the northwest corner of Wilbarger County to the southeast corner of Presidio County, are free and clear of splenic or Texas fever, and are not liable to convey this disease;

And whereas many of the cattlemen of this Territory have petitioned me to so modify said quarantine proclamation as to exempt cattle raised in, or that have been within said Panhandle for ninety days, from the operation thereof;

And whereas four of the nine stock commissioners for the Territory of Montana recommend that it be done, one refuses to give his voice for it or against it, says his county is not a cattle county, and the other four are opposed to it;

And whereas I have learned from the governors and veterinary surgeons of the State of Colorado and Territory of Wyoming, through whose jurisdiction lies the pathway of travel from the Panhandle part of Texas to the Territory of Montana, that the laws and quarantine regulations of that State and Territory allow cattle to be imported and brought from said Panhandle district into said State and Territory, and that no harm to the stock of their citizens has come of it; and the veterinary surgeon for this Territory has filed with me a full report of his views on the question, from which I quote the following, to wit:

"From all information which I have on this subject I have no reason to believe that cattle from the north or west of the above line are liable to convey this disease. Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, who has on behalf of the United States Government made the subject of Texas fever a special study for many years, in reply to a telegram which I addressed to him on the 1st instant, replied as follows: 'Do not consider cattle from Panhandle of Texas liable to convey splenic fever.'

"Further, I have no reason whatever to believe that cattle originally from points south and east of this line, but which have been ninety days or more north or west of said line, are liable to convey splenic fever; therefore I do not consider that the herds of Montana would be jeopardized by allowing bona fide Panhandle cattle, or cattle which have been ninety days or more north or west of the before-mentioned line, free entry into the Territory."

It is therefore deemed most reasonably certain that the said quarantine proclamations heretofore issued from this office may without danger of bringing into this Territory any contagious or infectious disease to domestic animals be modified.

Wherefore I, Preston H. Leslie, governor of the Territory of Montana, do by virtue of the power vested in me by law, hereby modify and change said proclamations so that the same shall not apply to that part of the State of Texas called and known as "The Panhandle," and which is the territory that lies and is north and west of a straight line drawn from the northwest corner of Wilbarger County to the southeast corner of Presidio County, in said State of Texas. And it is hereby declared that any cattle that have been and remained for all the time of ninety days or more within the said Panhandle part of the State of Texas, north and west of the line aforesaid, may be brought from there and admitted into the Territory of Montana without regard to said proclamation: *Provided, however*, Before they or any of them shall be brought into the Territory of Montana the owner and the person in charge of them must file with the veterinary surgeon their own written or printed affidavits, subscribed and sworn to before a notary public of Montana, and such other evidences and proofs as shall, with the said affidavits of the owner and person in charge, show and satisfy him that such cattle were within said Panhandle as before described for ninety days or more, immediately preceding their start from there for Montana, and have been or are being brought directly from that locality to Montana, and also that they have been subjected to the quarantine regulations of the State of Colorado and Territory of Wyoming on the way of their transportation.

In testimony whereof I have hereunto set my hand and caused the great seal of the Territory of Montana to be attached this May the 11th, 1888.

[SEAL.]

PRESTON H. LESLIE.

By the governor:

WM. B. WEBB,

Secretary of Montana Territory.

BISMARCK, DAK., March 31, 1888.

To H. M. TAYLOR, *Denver, Colo.:*

Texas cattle can not enter Dakota unless driven all the way.

E. J. ALLOWAY,
Territorial Veterinarian.

Quarantine proclamation.

TERRITORY OF WYOMING, EXECUTIVE DEPARTMENT.

Whereas the governor of Illinois, upon the certificate of the State board of live-stock commissioners, removed all quarantine restrictions then in force in Cook County, April 1, A. D. 1888, as no case of pleuro-pneumonia had been found since December, 1887;

And whereas there seems to be a doubt in the minds of many regarding the full power and force of the proclamation issued by the executive of this Territory under date of June 16, 1887, restricting the importation of neat cattle from Florida, Alabama, Mississippi, Louisiana, and from portions of Texas, Tennessee, Arkansas, South Carolina, and the Indian Territory, into Wyoming, because of the liability to infect our cattle with Texas or splenic fever;

Now therefore, I, Thomas Moonlight, governor of the Territory of Wyoming, by virtue of the authority vested in me by law, do hereby make proclamation, removing all quarantine restrictions against every portion of Illinois heretofore in force; and I do further proclaim and forbid the importation into this Territory of any neat cattle between the 1st day of April and 1st day of November in each year, whether brought in whole or in part by rail from the localities specified as liable to convey Texas or splenic fever, unless under the restrictions, requirements, and limitations set forth in the said proclamation, bearing date June 16, 1887.

In testimony whereof, I have hereunto set my hand and caused to be affixed the great seal of the Territory. Done at Cheyenne, this 30th day of April, A. D. 1888.

[SEAL.]

THOMAS MOONLIGHT.

By the governor:

S. D. SHANNON,

Secretary of Territory.

CHEYENNE, March 31, 1888.

To Col. H. M. TAYLOR, *Denver, Colo.:*

Texas cattle will be admitted into Wyoming without quarantine if they have been ninety days north and west of a line beginning at northwest corner of Wilbarger County, thence southwest to southeast corner of Presidio County.

JAS. D. HOPKINS,
Territorial Veterinarian.

Regulations of the Colorado veterinary sanitary board governing the admission of cattle into Colorado.

CATTLE.

There is an absolute quarantine against cattle from Kentucky, New York, Pennsylvania, West Virginia, New Jersey, Delaware, Arkansas, Connecticut, Maryland, Virginia, Massachusetts, Rhode Island, Vermont, District of Columbia, and Canada. Cattle from all other States and countries are required to present affidavits of two reputable citizens of the county in which the animals are owned, that they have been kept upon one farm for a period of four months immediately preceding date of shipment, during which time they have not had or been exposed to any contagious or infectious disease. Also a statement of the county clerk of the same county certifying to affiants' reliability, and the affidavit of the owner, that the cattle shipped are the same cattle named in the above affidavits, the above papers in all cases to accompany the cattle. Cattle destined for Denver, or points beyond, will be inspected at Denver. Cattle destined for Pueblo or points beyond will be inspected at Pueblo.

SOUTHERN CATTLE.

SECTION 1. The introduction of stock from all parts of the country south of the thirty-sixth degree of north latitude shall be governed by an act entitled "An act to prevent the introduction of infectious and contagious diseases among the cattle and horses of this State."

SEC. 2. Cattle destined for any point in Colorado must have been at least ninety days north or west of a line following the one hundredth meridian of longitude from the southern line of Kansas to its junction with the south line of Jones County, Tex.; then west along the south line of Jones, Fisher, and Scurry Counties; then south

along the west line of Mitchell County; then following the Government line to the Pecos River, and down that river to its mouth.

All cattle shall be entitled to a bill of health, if, on inspection, they are found free from disease, and proof is made that the regulations of this section have been complied with.

SEC. 3. In order that a bill of health can be procured from the State veterinary sanitary board, affidavits must be presented to the State veterinary surgeon, or his duly appointed inspector, setting forth the following facts, to wit: The State and county where the stock was raised and where they have been ranged during the previous ninety days, said affidavits to be accompanied by a certificate from the county clerk as to the owner or owners of the brand upon the stock, and by inspector's certificate.

The above affidavits must be made by the owner or owners of the stock before a legally authorized notary public, and affiant's reliability be certified to by the county clerk of the county where the animals range, and must in all cases accompany the stock. The person in charge of the stock must state under oath the route over which they have been driven, and must satisfactorily answer questions that may at the time be suggested.

SEC. 4. Cattle being shipped from south or east of the above defined lines through this State to the ranges of other States and Territories can be unloaded within this State only to be fed and watered, which feeding and watering must be done only in pens kept for that especial purpose, and kept properly disinfected by the several lines of transportation, which pens, as to location and construction, shall be approved by the veterinary sanitary board.

SEC. 5. In order to defray the expenses of inspection, as provided for by law, a charge of $1\frac{1}{2}$ cents per head will be charged upon all cattle and horses inspected.

F. P. ERNEST, *President*.

CHARLES G. LAMB,

Secretary, State Veterinary Surgeon.

Regulations of the cattle sanitary board of New Mexico, adopted April 17, 1888.

1. Until further provided no one will be employed to inspect cattle unless he is known to be a practical cattle raiser and owner in the Territory and directly interested in the cattle industry, except at places where persons of that class can not be found willing to serve. All inspectors are required to observe the strictest economy in incurring expenditures and are enjoined to avoid all unnecessary and unreasonable expenses in the performance of their duties.

2. Whenever it shall become necessary to seize and quarantine cattle that have been driven or transported into the Territory in violation of the law, any inspector for that purpose *shall* call to his aid a sufficient number of persons, expert in the handling of cattle, as may be necessary for that purpose; in which case all expenses of inspection and quarantine are to be borne by the owners of the cattle and for the payment of which there will be a lien on the cattle so seized.

3. From the 1st day of March to the 1st day of November of each year, *all* cattle before being imported into New Mexico, except as above provided, which, by any route, either direct or circuitous, could have been driven or transported from any part of the State of Texas, south and east of a line commencing at the northwest corner of the county of Wichita; thence running due south along the western line of Wichita and Archer Counties to the northeastern corner of Throckmorton County; thence due west to the northwest corner of said county; thence due south to the southwest corner of Throckmorton County; thence due west to the northwest corner of Shackelford County; thence due south to the southwest corner of said county; thence due west to the northwest corner of Taylor County; thence along the north line of Nolan and Mitchell Counties to the northwest corner of said Mitchell County; thence due south to the southwest corner of said Mitchell County; thence due west along the south line of the counties of Howard, Martin, and Andrews, to a point where the southeast corner of the Territory of New Mexico and the southwest corner of Andrews County, in the State of Texas, meet; thence due west along the south boundary line of the Territory of New Mexico to a point where the monuments marking the boundaries between the State of Texas, the State of Chihuahua, in the Republic of Mexico, and the Territory of New Mexico, and erected by the United States Boundary Commission, stand and are in place at the date of the enactment of this law, and more particularly the counties of El Paso, Presidio, Pecos, Tom Green, Crockett, Mitchell, Shackelford, Throckmorton, Archer, and Wichita, in the State of Texas, and all the counties east and south of the counties hereinbefore mentioned, and situated in the aforesaid State of Texas,

must be inspected and an investigation made by our inspector or other authorized person for the purpose of determining whether any of such cattle have or have not come from any place or district in the State of Texas south or east of said line.

4. In conducting such investigation the inspector will bear in mind that the object of inspection as to the cattle disease known as Texas fever is not to determine whether the cattle are infected with that disease, which can not be determined by an inspection, but to determine whether the cattle, or any of them, are or are not from any part of the proscribed territory of Texas, and for the purpose of determining whether the cattle destined for importation into New Mexico are or are not from any place, district, or locality quarantined against. All cattle which by any route, direct or circuitous, could have come from any such place, district, or locality, are subject to inspection.

5. If, upon investigation, it shall be ascertained that the cattle so inspected have not come from the aforesaid proscribed territory of Texas, or any part thereof, the inspector before whom the investigation is had will give the person in charge of the cattle a permit in writing or print, or partly in writing and partly in print, and issued by the inspector, to pass such cattle into the Territory to their destination therein, or to pass the same through the Territory when their destination shall be beyond the limits of the Territory; otherwise the inspector will refuse such permit, unless the cattle are to be transported entirely through the Territory of New Mexico by rail, under the conditions and restrictions prescribed by the quarantine law; in such case no inspection or permit will be required.

6. All permits to pass cattle into or through the Territory must contain the name of the owner, the name of the person in charge of the cattle, as owner, agent, or employé, a description of their cattle by their brands and ear marks, the place they came from, and their destination.

7. Cattle to be inspected as above required must be stopped before entering the Territory, at or within a reasonable distance of either or any of the following points of entry for the purpose of convenient inspection, and until otherwise provided, and notice published, no permits will be granted to pass cattle into or through the Territory, except at or near such points, viz:

Any part of the line between New Mexico and the State of Chihuahua, in the Republic of Mexico, within 200 miles of the city of El Paso, which is hereby designated as inspection district No. 1.

Any part of the line between New Mexico and the State of Texas, in the vicinity of El Paso in that State, which is designated as inspection district No. 2.

The point at or near which the Pecos River crosses the line between New Mexico and the State of Texas, designated as inspection district No. 3.

The point at or near which the Fort Sumner and Texas road crosses the line between New Mexico and the State of Texas, designated as inspection district No. 4.

The point at or near which the Canadian River crosses the line between New Mexico and the State of Texas, designated as inspection district No. 5.

The point where the Atchison, Topeka and Santa Fé Railway crosses the line between New Mexico and the State of Colorado, in the vicinity of Raton, N. Mex., designated as inspection district No. 6.

Provided, however, If the owner of the cattle to be inspected shall so elect and inform the proper inspector, an inspection may be made and a permit in like manner may be granted to pass cattle into the Territory at any other point designated by the importer, upon his paying the necessary expenses of inspection and the investigation, and by advancing to the inspector before the commencement of the investigation a sum of money sufficient to cover his per diem and traveling expenses, the amount thereof to be determined by the inspector.

8. Inspectors will not go beyond the boundary line of the Territory to inspect cattle upon the application of the owner or agent in charge except for the purpose of viewing the cattle and taking a description of them.

All oaths to witnesses must be administered and all necessary testimony taken within the Territory, and for this purpose the proper inspector will require the importer of cattle to be inspected to furnish within the Territory all the testimony which he may desire to offer, and which may be required for the purpose of inspection and investigation, to determine whether the cattle have or have not come from the aforesaid proscribed territory in the State of Texas.

9. All testimony taken before any inspector in any such investigation must be reduced to writing and reported to the sanitary board.

10. Any person having in charge any cattle destined for introduction into the Territory, and required to be inspected as above provided, may make application to the inspector designated at a place nearest to any of the above-mentioned points of entry where he desires to import his cattle into the Territory for an inspection of his cattle, and to make an investigation for the purpose aforesaid. Such applica-

tion must be in writing; and specify the number of cattle to be inspected, the owner's name, the place they came from and their destination; also the place where they have been stopped for inspection, and the distance, as near as known, to the nearest of the above-mentioned points of entry where or near which the importer intends to enter the Territory with his cattle; also specifying the time at which he desires the inspection to take place, which must be not less than ten days from the time the application is made.

11. Upon any such application the proper inspector shall make or cause to be made the required inspection and investigation and grant or refuse a permit as above provided.

12. All applications for inspection of cattle destined for entry into New Mexico, across the line mentioned in inspection district No. 1, will be made to S. S. Birchfield, of Deming, N. Mex., who will make the same in person or designate some other convenient inspector authorized by said board to make the same.

All applications for inspection of cattle to cross the line named in inspection district No. 2, will be made to John H. Riley, of Las Cruces, in the Territory of New Mexico, who will make the same in person or designate some other convenient inspector duly authorized by said board to make the same.

All applications for inspection of cattle to cross the line in said district No. 3, will be made to Henry Neafus, of Lookout, N. Mex., who will make the same in person or designate some other convenient inspector, duly authorized by said board to make the same.

All applications for inspection of cattle to cross the line named in said district No. 4, will be made to Carter Temple, of Fort Sumner, N. Mex., who will make the same in person or designate some other convenient inspector duly authorized by said board to make the same.

All applications for inspection of cattle to cross the line named in said district No. 5, will be made to T. G. Duncan, of La Cinta, San Miguel County, N. Mex., who will make the same in person or designate some other convenient inspector duly authorized by said board to make the same.

All applications for inspection of cattle to cross the line by rail named in said district No. 6, will be made to G. E. Lyon, of Raton, N. Mex., who will make the same in person or designate some other convenient inspector authorized by said board to make the same.

13. In case any of the inspectors above designated to receive applications for inspection shall be absent from their respective places of residence, they are required to arrange for placing any such application that may be made during such absence in the hands of some other convenient inspector for action.

All inspectors are hereby required to inspect under the governor's proclamation relating to pleuro-pneumonia, and guard against the entry of any cattle covered by such proclamation, except at the points and under the conditions and restrictions specified therein, as well as under the quarantine law respecting Texas fever.

14. The foregoing rules and regulations were adopted at a meeting of the cattle sanitary board of New Mexico, held at Deming, N. Mex., April 17, 1888.

WARREN BRISTOL,

LEWIS LUTZ,

Members of the Board.

POLICE POWERS.

While most of the Western States and Territories have live-stock sanitary boards, which efficiently enforce regulations looking to the protection of their live-stock interests from contagious diseases, at the same time some of the States and Territories are yet without any live-stock sanitary laws on their statute-books, and are consequently unable to protect themselves against contagious maladies. It has been a mooted question in the minds of some of our western sanitary authorities as to whether they had the right under the police powers they were exercising to question the health of cattle passing through their respective States and Territories, consigned to points outside their territory, if carried through in cars without being unloaded, or if unloaded, in pens provided for their special use and from which native cattle were excluded. If experience has demonstrated that there is possible danger to the health of cattle arising from the passing

through the territory of cattle as stated, I believe that it is in the province of the authorities of the State or Territory in which cattle may pass through en route to points beyond the State or Territorial lines, to require satisfactory evidence as to their freedom from disease, the same as they would require if the cattle sought admission into the Territory for the purpose of remaining. It is a well-known fact that litter from cars in which diseased animals have been carried will spread disease. It is a further well-known fact that litter is kicked out of the cars and scattered in places accessible to other cattle. If it is in the province of quarantine officials to prevent travel through the country of people who have been exposed to yellow fever and other diseases which afflict the human family, under the exercise of police powers, I think it is equally within the province of live-stock sanitary authorities to enforce such restrictive measures relating to the movement within their respective territories of cattle from infected districts as will protect beyond peradventure the health of the cattle of their States and Territories.

This is a very important question, for the reason that cattle from the eastern portion of the United States are being shipped through to Mexico, and while cattle from the same districts, from which cattle destined to Mexico originated, would be quarantined by State and Territorial authorities on account of the possible danger of disease, the mere fact that the cattle are consigned to Mexico has heretofore prevented our Western authorities from even inspecting them or looking into the condition attending them.

This is a matter to which I desire direct the attention of the live-stock sanitary authorities of our Western States and Territories.

UNIFORM SANITARY REGULATIONS.

Considerable inconvenience has been experienced by shippers in handling Texas cattle on account of the different live-stock sanitary regulations in force in different States and Territories, and also on account of want of knowledge of these regulations.

While the regulations of Dakota as to the admission of Texas cattle are almost prohibitory in their character, the regulations of most of the other Western States and Territories are more reasonable, and if not according the greatest possible freedom to the movement of Texas cattle consistent with safety, they do not place the entire State of Texas under ban. I have had frequent conferences with the live-stock sanitary authorities of most of our Western States and Territories, and I am led to believe that with the light that the Department can throw over the matter of splenic fever, and the facts we will be able to present before the next shipping season as to the infected portion of Texas, that uniform regulations on the part of all Western live-stock sanitary authorities can be secured, which will settle this vexed question in a manner that will be just and fair to the interests of all sections. There is some little difference in the regulations of the various Western States and Territories as to the admission of Eastern cattle, of which there is a great dread on account of the possible introduction of contagious pleuro-pneumonia. I have every reason to believe that uniform regulations as to the admission of Eastern cattle to the Western States and Territories can also be secured in the interest of commerce, as well as in the interest of protection. It is important that uniform regulations should be

secured, and that knowledge of them should be widely disseminated among shippers. It shall be my aim to secure these results during the coming year.

RAILROAD CO-OPERATION.

There has been a very general apprehension on the part of Western cattlemen that contagious pleuro-pneumonia would be introduced from the East upon Western cattle ranges. While most of the Western States and Territories have enacted effective sanitary laws which are being efficiently enforced by capable officials, at the same time some contiguous States and Territories have been without any live-stock sanitary laws, and, in consequence, without any power to protect themselves from the introduction of diseased cattle. Until recently Dakota was without any effective legislation on this subject, which endangered the herds of Montana and Wyoming to almost as great an extent as if those Territories had not done all that was in their power to protect their interests. Texas, at the present time, is in the position formerly occupied by Dakota, and the only protection she has is afforded by the law under which the Bureau of Animal Industry is operating.

The managers of the railways belonging to the Texas Traffic Association being fully alive to the danger, and appreciating the fact that their interests are in common with the cattle producers from whom they receive on an average a fifth of the annual returns from the sale of beeves in the way of freights, expressed a desire to have the Department issue regulations placing restrictions upon the movement of cattle from districts in the East infected with pleuro-pneumonia. I have attended a number of meetings of this association, and I have always found its members ready and anxious to co-operate with the Bureau to the fullest extent.

The following is a copy of a circular that has been issued by the managers of all the railroads belonging to the association to their agents, the enforcement of which affords a degree of protection not previously attained:

The Texas Traffic Association.

The Atchison, Topeka and Santa Fé Railroad, and the Southern Kansas Railway Company.
The Gulf, Colorado and Santa Fé Railway Company.
The Houston, East and West Texas Railway, and the Shreveport and Houston Railway Company.
The Houston and Texas Central Railway.
The Kansas City, Springfield and Memphis Railway, and Kansas City, Fort Scott and Gulf Railroad.

The Missouri Pacific Railway Company.
The Memphis and Little Rock Railroad Company.
The Southern Pacific Company—Atlantic system.
The St. Louis, Iron Mountain and Southern Railroad Company.
The St. Louis, Arkansas and Texas Railway.
The St. Louis and San Francisco Railway Company.
The Texas and Pacific Railway.
The Texas Central Railway.

CIRCULAR No. 246.

HOUSTON, TEX., December 16, 1887.

The executive committee of the Texas Traffic Association at convention held at St. Louis, October 20, 1887, adopted the following:

“Resolved, That the attached circular relative to the establishment of rules for the transportation of cattle into Texas from territory east of the Mississippi River, be submitted by the commissioner to the several lines in the association, with request that they advise their views as to the advisability of its issuance. In the

event all lines agree to the proposed regulations, the commissioner will fix a date the instructions shall be put in effect by the several companies."

In receiving shipments of cattle originating east of the Mississippi River, and destined for points within the State of Texas, the agents of these companies will be governed by the following rules:

The attention of shippers will be directed to the sixth and seventh sections of the act of Congress of March 29, 1884, for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals, reading as follows:

"That no railroad company within the United States, or the owners or masters of any steam or sailing or other vessel or boat, shall receive for transportation or transport from one State or Territory to another, or from any State into the District of Columbia, or from the District into any State, any live-stock affected with any contagious, infectious, or communicable disease, and especially the disease known as pleuro-pneumonia; nor shall any person, company, or corporation deliver for such transportation to any railroad company, or master, or owner of any boat or vessel, any live-stock, knowing them to be affected with any contagious, infectious, or communicable disease; nor shall any person, company, or corporation drive on foot, or transport in private conveyance from one State or Territory to another, or from any State into the District of Columbia, or from the District into any State, any live-stock, knowing them to be affected with any contagious, infectious, or communicable disease, and especially the disease known as pleuro-pneumonia; provided, that the so-called splenic or Texas fever shall not be considered a contagious, infectious, or communicable disease within the meaning of sections 4, 5, 6, and 7 of this act, as to cattle being transported by rail to market for slaughter, when the same are unloaded only to be fed and watered in lots on the way thereto.

"That it shall be the duty of the Commissioner of Agriculture to notify, in writing, the proper officials or agents of any railroad, steam-boat, or other transportation company doing business in or through any infected locality, and by publication in such newspapers as he may select, of the existence of said contagion; and any person or persons operating any such railroad, or master or owner of any boat or vessel, or owner or custodian of, or person having control over, such cattle or other live-stock within such infected district, who shall knowingly violate the provisions of section six of this act, shall be guilty of a misdemeanor, and, upon conviction, shall be punished by fine of not less than one hundred dollars nor more than five thousand dollars, or by imprisonment for not more than one year or by both such fine and imprisonment."

And to that portion of the circular letter of United States Commissioner of Agriculture Norman J. Colman, under date of Washington, D. C., May 31, 1887, reading as follows:

"To the Managers of all Railroad and Transportation Companies in the United States:

"Your attention is called to the fact that contagious pleuro-pneumonia exists among cattle in Cook County, Illinois, and in the States of Maryland and New York, and that the infected districts in said States have been duly quarantined by the Department of Agriculture in the manner provided by the act of Congress of March 29, 1884, establishing the Bureau of Animal Industry.

"Transportation companies, having connections with infected districts, should require parties offering cattle for shipment to present, at points of loading, affidavits of the owner and two disinterested persons, stating that the cattle to be shipped have been known to affiants for at least six months next preceding, and that said cattle have not been in any of said districts, and have not come in contact with any cattle from said districts. Said affidavits should be attached to and accompany the way-bill to point of destination."

The owners or custodians in charge should be requested to show the affidavits as described above, that the origin and condition of the cattle may be known.

Cattle known to be from infected districts, as described in the Commissioner's circular above referred to, or from districts hereafter designated by the Commissioner as infected, must not be received for transportation, but such may be offered from other territory east of the Mississippi River, not accompanied by the aforesaid affidavits, may be received and forwarded, provided the agent receiving the same is without knowledge that the cattle are diseased, or are from an infected district; and, provided further, that the transportation of said cattle does not violate any Texas quarantine regulations. But on receiving cattle coming from territory east of the Mississippi River, and not accompanied by the aforesaid affidavits, the agent receiving and forwarding same should at once furnish the general freight office information of such shipments, specifying number and kind of cattle, names of con-

signor and consignee, and way-bill reference, that such information may be furnished the officers of the United States Bureau of Animal Industry as will enable them to trace the cattle.

Approved:

For the Atchison, Topeka and Santa Fé Railroad and the Southern Kansas Railway Company,

J. F. GODDARD, *G. M.*

For the Gulf, Colorado and Santa Fé Railway,

W. SNYDER, *G. M.*

For the Houston, East and West Texas Railway Company and Shreveport and Houston Railway,

M. G. HOWE, *Receiver and G. M.*

For the Houston and Texas Central Railway, and Texas Central Railway,

CHAS. DILLINGHAM, *Receiver.*

For the Kansas City, Springfield and Memphis Railway, and Kansas City, Fort Scott and Gulf Railroad,

GEO. H. NETTLETON, *President and G. M.*

For the Missouri Pacific Railway Company,

W. H. NEWMAN, *3d V. P.*

For the Memphis and Little Rock Railway,

RUDOLPH FINK, *President and G. M.*

For the St. Louis, Arkansas and Texas Railway,

R. C. KERENS, *V. P.*

For the St. Louis, Iron Mountain and Southern Railway Company,

W. H. NEWMAN, *3d V. P.*

For the St. Louis and San Francisco Railway,

H. L. MORRILL, *2d V. P. and G. M.*

For the Southern Pacific Company—Atlantic system,

A. C. HUTCHINSON, *G. M.*

For the Texas and Pacific Railway,

JOHN A. GRANT, *G. M.*

This circular was forwarded from this office for signature November 1, 1887. Returned, signed as above and ordered printed December 16, 1887, and is hereby made effective January 1, 1888.

Official.

(Signed by Commissioner.)

I have found the managers of western railway lines to be equally alive to the importance of doing all in their power to protect the cattle interests of their respective territories, and in all cases the western roads have instructed their agents to respect and carry out the quarantine regulations of the States and Territories which they pass through. As indicating the general tenor of the action that has been taken by railroads in this important matter, I attach hereto a letter from the general freight agent of the St. Louis and San Francisco Railway Company, which is a sample of numerous other letters I have from officials of other roads:

ST. LOUIS, *October 10, 1887.*

H. M. TAYLOR, Esq.,

*Agent U. S. Bureau of Animal Industry,
Kansas City, Mo.:*

SIR: Your circular letter of the 7th instant, calling attention to Commissioner Colman's circular of May 31 last, is before me. In reply to same beg to state, for your information, that we have been as careful of the live-stock interests of the Indian Territory, where they have no laws to protect them against disease, as we have been of any other territory where these interests are protected by the act of legislature. We have declined to transport cattle into the Indian Territory from the State of Texas, or from any other quarter, where disease has been known to exist, believing that by so doing we were protecting our own interests as well as those of the cattle shippers and owners. You can rely upon our hearty co-operation in the matter referred to in your communication.

Yours truly,

G. W. CALE, *G. F. A.*

I would suggest to the different State and Territorial live-stock sanitary authorities the importance of arranging with railroad com-

panies for the entrance into their territories, of eastern cattle, at as few points as possible, in order to simplify the work of inspection, and assist the railroads in the meritorious work they have undertaken.

MEXICO WITHOUT SANITARY LAWS.

The unfortunate condition of the State of Texas, by reason of the absence of sanitary laws for the protection of her live-stock interests, is aggravated because the same condition of affairs exists in the neighboring Republic of Mexico. If it were not for the customs duties, which retard the trade between the two countries, the interchange of live-stock of all classes would be very great. Even as it is, cattle, sheep, and horses pass each way daily, and the danger of disease is none the less because no disaster is yet upon record.

The range districts of Texas join the range districts of Mexico, and at times of low water in the Rio Grande River, cattle pass and repass without hindrance. The danger arises from the cattle and horses shipped from the infected districts of the United States and Europe into Mexico without inspection or restriction. Mexico receives stock from Europe at her eastern sea-ports without inspection, and is in constant danger of the introduction of disease. The International Range Association has directed the attention of the Mexican authorities to the present unprotected state of that country, and urged them to place such safeguards around their cattle industry as will keep out the contagious diseases which have decimated the herds of other countries.

THE RANGE SHEEP INDUSTRY.

So far as my observation has extended, since my last report, the range sheep interest has suffered from no contagious disease, except scab. The flocks have been and are healthy. Range sheep passed through the winter with no greater than the average loss, and the spring increase of lambs was very large in proportion to the number of ewes. In Montana the reports are the most favorable, although the entire range country seems to be satisfied in this particular.

There does not seem to be any increase in the number of range sheep during the last few years, unless a slight increase in Colorado and Montana can be counted. In Texas and New Mexico the industry has declined rapidly, and is about 60 per cent. of the numbers carried four or five years ago. As a whole, the range sheep are declining in numbers at a rapid rate, and unless wool sells at higher prices than can now be obtained, the range sheep interest will be largely reduced by sales of stock sheep upon the butcher market.

The sheep industry of the arid region is dependent for existence upon each flock securing a range to run over at little or no cost. In only a few isolated cases is any winter provision furnished, and the bands of sheep having to subsist at all seasons upon the native grasses of public lands, the maintenance of the flock in its entirety during a rigorous winter is very much more doubtful in the case of a large flock closely herded over a scanty range during the day, and penned or bedded on the open range at night, than in the case of cattle turned loose to obtain the best picking they can find both night and day. The matter is one of great surprise to me that under the range system sheep exist at all, but the evidence is good that

when the prices obtained for wool and mutton are apparently sufficient to justify the additional outlay for winter provision, upon ranges of the West and Southwest, the increase is easily perceptible, the reverse being the rule under directly opposite conditions.

The sheep interest of the western plains and mountain regions has undoubtedly an important and beneficial place in the domestic economy of the United States, inasmuch as the supply of wool and mutton obtained has greatly decreased the cost of both mutton and wool to the consumers. I have heard the number of range muttons to be marketed the present year from all points of the range country placed at 2,500,000 head, and the entire wool clip to be no less than 75,000,000 pounds. The estimate would place the number of range sheep at about 15,000,000 head. The tendency of the times is for the sheep-raiser of the West to acquire range by purchase, then to gradually work towards a proper system of stock-farming, changing his methods as means and intelligence dictate. Sometimes this causes a decrease in the flock, but it generally leads towards safety for the investment, and more uniformity in the amount annually derived as the income.

My observation for several years of the nomadic sheep-raiser causes him to be placed in the category of a public nuisance. With a band of 3,500 head, or two or three bands of 2,250 head each, his sheep patrol the streams of a district, and being herded closely, eat out the choicest portions of the ranges, then seek new fields and pastures. The abandoned ranges are useless for cattle, and if used for other sheep generally produce a vigorous epidemic of scab. To this heavy pasturing of watered districts, of large, dry, public ranges, can be attributed the original ill-feeling between cattlemen and sheepmen which has caused so many disgraceful encounters for the possession of public lands.

As stated in a former report, cattle will not willingly range upon a grazing district which has been closely grazed by sheep. The word "closely" is necessary to the statement, because it is the smell of the sheep that is offensive, and when a large band of sheep passes over a range the grazing is necessarily short. I know, however, that in many instances reasonable numbers of cattle and sheep are using the same ranges and pastures with evident satisfaction to the owners, to stock, and with benefit to the pastures, and it is fully recognized by intelligent and practical stockmen that sheep can be so distributed over a range as to be a positive benefit to it, and, in time, by destroying the crops of weeds, to improve the chances of growth to the rooted grasses.

The area of territory once available for sheep ranging is now very much curtailed. The settler on the one hand and the cattlemen on the other are acquiring titles to land in all parts of the range country, and the laws of several States and Territories being enacted to require sheep to be ranged upon the lands of the owner, or on public lands, the matter of sheep-trespassing on private grazing grounds is too serious to be attempted. I am of opinion that these range matters are becoming local issues, and that satisfactory adjustments of range privileges are more often consummated than when in nine out of ten cases the differences grew out of the desire to absolutely control lands that were public property, and I think that the range sheep interest is more nearly settled upon land titles now than ever before.

Last spring somewhat unexpectedly a rise in the price of mutton took place, but only one section of the range country (Texas) was in

a position to profit by it. Southern Texas had large numbers of fat muttons, and in north Texas there were quite a few. The run of mutton to market became very strong and prices were not long maintained.

The market is now in a satisfactory condition enough to induce mutton shipments, but the poverty of the range sheep, at this time and at this period in several years, goes to show that the range can furnish thousands of wethers fit for a farmer to put on full feed, where only hundreds are ready for the butcher's block. This I contend is the mission of the range from this time forward, to raise feeding muttons for the farmers of the corn States. The State of Nebraska feeds more range sheep now than all the balance of the United States, and the farmers of the interior States are buying half fat sheep that are shipped to the large markets.

RANGE HORSES.

The raising of horses upon the public lands of the West as an industry has caused very little comment. The droves are smaller than cattle or sheep, but the industry is generally successful and the stock is exceptionally free from disease. Very many of the range horses were from Texas originally, and the horse drive followed a wide trail towards Fort Dodge, Kans., that place being a recognized distributing point. Of late these drives have almost terminated, and the demand seems to have dropped off.

All the northern herds, including horses raised from Indian ponies, are greatly improved, the combined effect of breeding and climate seemingly resulting in the improvement of the common breeds. The best range horses are in Washington Territory, Oregon, Idaho, and in Montana. Wyoming also raises some fine specimens, but further south the animals are smaller in size and are not so uniform in character.

No important question in relation to the horse interests of the country in which I am employed has become apparent, the horse-raising industry of the ranges being on a prosperous basis and conducted without friction with other interests. In view of the possible introduction of glanders, and other contagious diseases, amongst these range horses, all regulations leading to control of the movement of horses towards these ranges which can be instituted under United States laws, will be greatly beneficial to an industry well worthy of the fostering care of the Government.

FARMERS TAKING THE RANGE.

The range live-stock interests were at the height of prosperity in 1884. Then nearly every piece of available ground was occupied by cattle, horses, or sheep, and the amount of territory so occupied was greater than at any previous time. Since 1884 the amount of territory on which range cattle were raised has been greatly curtailed by the inroads of farming settlers. The settlement of the western country is now rapid, and the amount of land withdrawn from the public domain by settlement is very large; yet the loss to the range interest is tenfold greater than the amount of land actually occupied by the settler. The sections occupied by the settlers are seldom adjacent to each other, are located here and there upon the streams, in the valleys, and wherever choice irrigable lands can be obtained.

The intermediate lands are occupied by the little herds owned by the settlers, and the country thereabouts is no longer available for range cattle. The farmers are able to closely stock the country they use, and save themselves from winter losses on short range by feeding alfalfa, sorghum, and other forage crops. The small herds aggregate more cattle after settlement, according to the acreage used, than the same territory would support under the range system.

In former reports mention was made of the fact, still apparent to myself, that in the arid region there are lands to ever remain as now, and of but little use to the nation for agricultural purposes, and unless obtained in large tracts by lease or purchase no revenue can be derived therefrom, and appearances indicate the live stock-business to be the only chance of keeping these arid tracts from being utterly worthless.

As the settler drives away the herds of cattle, horses, and sheep from the heretofore immense grazing fields of the Government, the range industry is pushed back upon these permanent ranges, and to save himself from still further movement, the ranchman becomes in turn a settler, seeking to hold as much range as possible by means of water rights and claims.

As the ranges decrease in extent the range herds must be curtailed in numbers, or the winter storms and summer droughts will cause disaster. Disasters have occurred on every range fully occupied, from the northernmost line of Montana to the Texas ranges on the Gulf coast, and the fear of losses through overstocking ranges, combined with the inroads of settlers, is causing ranchmen to intrench themselves behind land purchases and leases wherever they can reasonably be obtained.

In 1884, Mr. Nimmo, then Chief of the Bureau of Statistics, published a map showing the land then used as grazing territory. Now, three years later, one-third of that grazing area is unavailable, and is already occupied by the stock farmer.

DEEP WATER ON THE TEXAS COAST.

The stock interests of the western country are desirous to see the Federal Government take decided action to concentrate all appropriations made by the river and harbor bill for Mexican Gulf ports upon one Texas harbor, with a view to secure a deep-water port capable of admitting the large ocean-going vessels. This was expressed in a resolution unanimously adopted by the International Range Association at the last meeting, held at Denver, Colo., as follows:

OFFICE OF THE INTERNATIONAL RANGE ASSOCIATION,
Denver, Colo., April 2, 1888.

To the Senators and Representatives in the Congress of the United States:

I am directed by the International Range Association to call your attention to the following resolution, passed unanimously at the regular meeting of the association recently held in this city, viz:

"Resolved by the International Range Association, That Congress be, and is hereby, earnestly urged to provide measures to secure a deep-sea channel at some point on the Texas coast."

Very respectfully,

H. M. TAYLOR,
Secretary International Range Association.

No expression was adopted with more unanimity, and none was more important. The immense ranges of the West produce hun-

dreds of thousands of live-stock that will not bear transportation to the eastern seaboard by an all-rail route, or can not find a foreign outlet at prices that will justify the present transportation charges by land and by sea.

The Denver, Texas and Gulf Railroad, which was completed last spring, gives to the range interests of a large portion of the West a rail route to the southern coast that is one thousand miles nearer than the old eastern routes, and a deep-sea channel and port on the Texas coast will enable the eastern seaboard to receive western supplies now virtually cut off for want of transportation facilities, and at the same time the port will furnish a much-desired outlet for range-stock and many other products of the plains.

RAIL AND TRAIL.

The highest number of cattle ever driven from Texas to the northern cattle ranges in one year was 416,000 head. This was in the year 1884. Since then the drive has decreased until the present year's movement will not exceed 150,000 head in all. Of these, only 26,000 were on the road trail early in June, and the probabilities of the entire Texas and New Mexican drive will not exceed 50,000; all others going by the rail route. This change is due largely to the railroad connection between the Texas coast and Denver, Colo. The small movement is due to depression in the industry, the decrease in amount of range territory available for cattle ranching, and partly to the difficulty of moving southern cattle to northern Territories by reason of sanitary enactments. In future the movement of cattle from the breeding grounds of the South to the fattening ranges of the North, owing to the settlement of the country, will take place almost entirely by rail. This change will be a beneficial one, for the reason that it will insure the delivery of cattle from the South, even in extreme northern ranges, sufficiently early in the season to get fat before winter storms commence, thus reducing the percentage of loss and adding greatly to the growth of the cattle. The railroads interested in this movement have made very reasonable freight rates, and have shown commendable zeal in extending every possible facility for its success.

IMPROVED STOCK CARS.

Improved cars, in which cattle can be fed, watered, and separated into compartments, have attracted general attention during the past year by reason of the success which has attended their use. Only a few of these cars are in operation, however, compared with the total number required, but commendable energy is being displayed by railroads and private car companies to bring into use as many of these cars as will be necessary for all the long runs to market. The principal cause operating against the rapid introduction of improved cars is that they supersede and render nearly worthless the old-style stock cars, which are used in large numbers by all railroad companies, and are capable of use for return freight. The western and southwestern roads charge extra for the use of the stable stock car. The railroads between Kansas City, St. Louis, and Missouri River points make no additional charge. The first road officially notifying stock associations that they would transport cattle in the stable cars without extra charge was the Chicago, Alton and St. Louis Railroad. So far as my observation extends the Burton stable car is the most elab-

orate and the best designed for the transportation of valuable stock, but some of the Burton cars labor under the disadvantage that the partitions separating their cars into compartments are permanent, interfering to some extent with the use of the car for return freights.

The following statistics and information concerning early live stock shipments in the Burton car are authentic and reliable:

KANSAS CITY, MO., November 2, 1887.

Col. H. M. TAYLOR,

*Chairman Committee of Transportation,
Cattle-Growers' Convention, Kansas City, Mo.:*

SIR: Replying to your inquiry concerning actual tests of saving in shrinkage and gain in time by transporting range cattle in the Burton feeding and watering cars, I will say that careful and accurate tests show a gain of 40 per cent. in time and transit, and actual saving in shrinkage of from 50 to 135 pounds per animal (according to distance shipped), over the old system of common stock cars and feed yards. Will note one instance as an example. In August, 1886, we brought wild range cattle in sixteen Burton cars, from Winslow, Ariz., to Kansas City, a distance of 1,204 miles. These cattle were weighed on live-stock scales at Winslow, and averaged 935 pounds each. They weighed 882 pounds each at Kansas City, shrinking only 53 pounds per head. They were off fresh grass.

The running time was about seventy-two hours. The cattle consumed 6,600 pounds of hay and were watered in the cars twice each twenty-four hours, drinking freely each time. The steers rode very nicely, as many as fourteen steers lying down in a car at one time, chewing their cuds. They arrived at Kansas City without an injured or lame animal.

In December, 1886, a test was made of shipment in common cars to Kansas City, a distance of 1,196 miles. The cattle were unloaded and reloaded at feeding yards en route; were five days (120 hours) in transit, and shrunk 188 pounds per head. This actual test, carefully conducted between the common stock-car system and the Burton cars, shows a saving of 135 pounds per head in favor of the improved stock-car transportation. This 135 pounds, at \$3 per cwt., equals a gain of \$4.05 per head, or \$81 per car (on twenty head to a car) in the matter of shrinkage alone. But the gain does not end there. The improved cars preserve the condition of the animals to such an extent that the cattle readily sell from 20 to 35 cents per hundred more on the entire carcass than similar animals on same market that have been transported the same distances in the common stock cars. For evidence, attest papers attached from shippers and commission men.

As to expense to railway company in handling the improved stock cars, we have affidavits from train service showing that full trains of Burton cars, loaded, have been, pulled over the continental divide with less expenditure of motive power than trains of common stock cars of same length.

All of which is very respectfully submitted by the Burton Stock Car Company.

ERSKINE R. MERRELL,
General Agent.

KANSAS CITY, MO., May 3, 1887.

Mr. ERSKINE R. MERRELL,

General Agent Burton Stock Car Company, Kansas City, Mo.:

SIR: Having sold seven loads of the cattle for Mr. James A. Alcock, which were transported from Engle, N. Mex., in the Burton stock cars, we were much pleased with your improved system of transportation, which gains so much time and saves so much shrinkage over the common stock cars and feed-yard system. These cattle reached Kansas City at 10 a. m., Monday, May 2, and we sold them before 3 p. m., same day, at \$3.80 per hundred, which was freely admitted to be 20 cents per hundred higher than similar cattle on same market that were transported a like distance in common stock cars. In our fourteen years' experience on these yards we never saw range cattle delivered here in such fine condition. Several buyers said they would give 10 to 20 cents per hundred more for cattle transported in the Burton stock cars than for similar cattle arriving in common stock cars which had been unloaded and reloaded at feed yards, and had been twice as long in transit.

Respectfully,

WHITE & RIAL.

THE CARRIZOZO CATTLE RANCH COMPANY,
White Oaks, N. Mex., May 7, 1887.

E. R. MERRELL, Esq.,
General Agent Burton Stock Car Company, Kansas City, Mo.:

SIR: The shipment of steers we made last week in the Burton stock cars was a complete success in every way. The steers sold by White & Rial netted us over \$28, and I consider that we gained at least \$3 per head by using your cars. Under no circumstances shall I ever make another shipment of steers for the eastern market in the old-fashioned cars. I trust that the success of our last shipment will destroy the prejudice that so many western stockmen have for improved stock cars.

Very truly yours,

JAMES A. ALCOCK.
JAMES C. NABOURS,
Foreman.

Subscribed and sworn to before me this 20th day of June, 1887.

[L. S.]

P. CONNELLY,
Notary Public.

The Street stable car was first brought to my notice last year by the shipment of Montana cattle to Chicago, by Reynolds Bros., of Albany, Tex. These gentlemen are ranching and shipping beef both from Montana and from Texas, and they have just concluded an arrangement to use these cars for a fixed period.

Dr. A. E. Carothers, a gentleman owning an extensive ranch in La Salle County, Tex., and who applies wealth, intelligence, and enterprise to his business, has used the Street stable cars in some of his late shipments. Dr. Carothers's experience with this car was given to Mr. L. A. Heil, the San Antonio correspondent of the Texas Live-Stock Journal, as follows:

Two train loads of cattle were shipped to Chicago, one in the common flat car, and the other in Street stable cars. They were both of the same lot of cattle. Those in the common cars were the first loaded. On their arrival in market the cattle averaged 858 pounds each, and sold for \$3.20 per hundred pounds. The cattle shipped in the Street stable cars averaged 908 pounds each, and sold for \$3.40 per hundred pounds. The freight on the cattle in the Street cars cost 50 cents per head more than the freight on the cattle shipped in the common cars, which left a balance of \$2.92 per head in favor of the cattle shipped in the stable car, amounting to \$70.08 per car, or \$1,001.20 for a train load of fifteen cars.

The following are some earlier tests with the Street stable cars:

Test No. 1.—Report on Colorado cattle from Chicago to New York; shipped in Street's stable car line cars, for L. Waixel, on July 4, from Chicago, 32 cattle, Colorados, in two cars:

	Pounds.
32 cattle weighed in Chicago	41,120
32 cattle weighed in New York	39,950
Shrinkage	1,170

32 cattle, 1,170 pounds shrinkage equals $36\frac{9}{16}$ pounds per head.
From same lot of cattle, 48 cattle in three Michigan Central large cars:

	Pounds.
48 cattle weighed in Chicago	59,630
48 cattle weighed in New York	56,450
Shrinkage	3,180

48 cattle, 3,180 pounds shrinkage equals $66\frac{1}{2}$ pounds per head. Difference in shrinkage per load, 475 pounds. Worth in New York 5 cents per pound, value equals \$23.75.

Test No. 2.—Report native cattle, Chicago to New York: shipped for T. C. Eastman, in Street's stable cars, May, 1885, 51 cattle.

	Pounds.
Live weight Chicago	70, 278
Live weight New York	69, 207
Average weight Chicago	1, 378
Average weight New York	357

Shrinkage per head 21 pounds. Gross dressed weight New York 39,735½ pounds. Compared with Chicago weight 56.54 per cent.

From same lot of cattle, 24 cattle in Lake Shore and Michigan Southern large 34-foot cars:

	Pounds.
Live weight Chicago	46, 690
Live weight New York	45, 220
Average weight Chicago	1, 373
Average weight New York	1, 330

Shrinkage per head 43 pounds. Gross dressed weight New York 25,610 pounds. Dressed weight compared with Chicago weight 54.16 per cent. Value of amount saved per car load equals \$26.88.

Test No. 3.—Shipped for Mr. Ora Haley, of Laramie City, Wyoming, September 19, 1885, from Rawlins, Wyoming, in Street's stable car line cars Nos. 47 and 48, 37 head of cattle:

	Pounds.
Rawlins weight	46, 500
Chicago weight	44, 850

Shrinkage

1, 650

Shrinkage per head 44¾ pounds. Time coming through, 110 hours. Distance, 1,216 miles. Shrinkage 3.72 per cent.

From same lot of cattle: In Chicago, Milwaukee and St. Paul or Union Pacific cars No. 5631 and No. 4965, 38 cattle:

	Pounds
Rawlins weight	49, 350
Chicago weight	43, 380

Shrinkage

5, 970

Shrinkage per head 157 pounds. Same time through (110 hours). Shrinkage 13.77 per cent. Amount value saved equals \$97.05 per car load.

The above statement of results from shipments of cattle in the Street stable car is correct.

JOHN W. STREET.

KANSAS CITY, November 2, 1887.

The Newell car is an adaptation of the common car, bringing into use compartments, watering troughs, and feed racks. It is also arranged to permit all attachments to be folded out of the way to admit the carrying of all other freights.

In addition to the above are the Armes car, the Canda car, the American Express car, and the Shellabarger car, which are also highly endorsed, and doubtless as good as those cars more fully mentioned. As these cars have not been in general use in the West I have not had an opportunity to examine them.

The following circular, issued by direction of the International Range Association, shows the interest manifested by stockmen at large in the improved method of live-stock transportation:

OFFICE OF THE INTERNATIONAL RANGE ASSOCIATION,
Denver, Colorado, May 10, 1888.

To cattlemen and managers of transportation lines:

The following resolutions were unanimously adopted by the International Range Association, at its third annual meeting, held at Denver, Colo., March 29, 1888:

"Whereas there has been a large reduction in the prices realized by the range cat-

tlemen for their beeves and a material increase in the expense of maintaining herds on the range, and

"Whereas the various railroads carrying our beeves to market have not extended the facilities needed for the transportation of stock: Therefore be it

Resolved by the International Range Association, That we demand of the railroad companies that they give the benefit of the improved stock cars now offered, thereby reducing our shrinkage and performing a humane act which would be appreciated by all; also a reduction of rates in proportion to the decline in prices realized; and be it

Resolved, That all range cattlemen are generally requested to patronize the railroads that furnish the facilities asked for.

Resolved, further, That the board of directors of the International Range Association are hereby instructed to consider the matter of transportation and the use of improved stock cars and issue an address to the cattlemen of the range country on the subject."

In accordance with the above I am directed by the executive committee of the International Range Association to state that the relations between transportation lines and the producers of live-stock are necessarily close. The interests of one can not be seriously affected without in a corresponding degree affecting the welfare of the other; their interests, in a word, are not antagonistic but mutual. We therefore believe this truth is fully appreciated by the transportation lines, and that any real grievance suffered by the producer of live-stock at the hands of railroad companies will be generously considered and favorably acted upon when fairly and temperately brought to their notice.

In view of the astonishing progress that has been made during the past quarter of a century in every branch of mechanics, it is astonishing that so little has been done in providing better facilities for the transportation of live-stock. It would seem that the only result arrived at has been to carry animals from the point of shipment to destination alive—when that feat has been accomplished the shipment has been regarded as successful, and the success in each case is measured by the number of deaths en route, merely maimed and injured animals not being seriously considered.

We are glad to say there are evidences of the dawn of a new era. The interests of shippers, and those of transportation lines as well, call for a forward movement on this question. Consideration for the public health and a decent respect for the dictates of humanity, cry out for something better in which to transport live animals than the old flat car, which has been in use for generations. It is but a short time since the first attempt was made to provide an improved stock car, but the importance of the subject, the general anxiety, the demand for something better, has stimulated invention, and several cars are now before the public as candidates for favor and endorsement. Their introduction has not been encouraged by the transportation lines, but they have been tried and have achieved surprising results. Animals in these improved cars are not made to suffer for either water or food; they are not exposed to cruel and inhuman torture by being thrown about the cars by the sudden stopping and starting of trains; beef cattle do not reach the hands of the butchers fevered for the want of water and nourishment, or covered with festering wounds and bruises.

If the number of beeves that reach the markets of the country and are hung up in butchers' stalls, which by reason of the privations and cruelty of their shipment are utterly unfit for human food, could be ascertained and published it would be appalling. There is a rapidly-growing realization of these things, which means a correction of the present system.

We believe that in time the old cars will disappear and in their place will come something abreast with the age and in harmony with the interests of all concerned.

When once the railroads begin these improvements their well-known enterprise will cause them to go forward until the very best improved cars will be considered none too good for universal use.

The fact that it has been demonstrated that cattle can be shipped long distances humanely, without injury and in condition to render them fit for healthful food, renders it certain that the old methods of transportation must and will be reformed.

We think that the extremely low prices prevailing call for and would justify a corresponding reduction in transportation rates.

We believe that stock cars should be made of uniform length, or that short cars should be furnished at a rate reduced to correspond with their length, and that all cars of the old pattern should be provided with means for feeding and watering stock as well as for dividing them into compartments.

We believe that stock trains should be run at as high rate of speed as is consistent

with safety, and that stock trains should have the right of way as against trains carrying only dead freight.

We think that stock cars should be equipped with air brakes and suspension trucks.

In view of the fact that some railroad lines have already yielded to the demand for better transportation facilities, it is fair to assume that united effort on the part of stockmen will result in the general use of improved stock cars. A refusal to patronize lines that adhere to the old methods will speedily bring about a reform, and we urge all those interested in this important question to persist in their demand for improved stock cars.

I am requested, further, to invite all railroad companies that are willing to extend the facilities of improved stock cars to their patrons to notify me of the fact, that I may give such publicity to the same as will prevent discrimination of shippers against the lines that stand ready to meet this humane and necessary demand.

H. M. TAYLOR,

Secretary International Range Association.

I am fully convinced that the improved car for cattle transportation is destined to work its way into general use, except, perhaps, on short single-day hauls. For long shipments the humane feature of preserving cattle from bruises, jamming, prodding, and averting the fevered condition attendant on long runs in the old cars, without feed or water, is assisted greatly by the economical side of the subject. The results of shipments in these various improved cars have been financially successful in so far as the cattle lose but little flesh in transit and sell for more money in the market than the additional cost of transportation comes to. In my opinion the general use of these improved cars will enable beef producers to take their cattle from their feeding farms and ranches direct to consuming centers, and avoid what is now generally admitted to be the great evil from which the industry is suffering, of having all western cattle go to one market where there is practically no competition. In short, the general use of these cars will prove to be the most potential factor in securing for cattle raisers fair prices for their cattle in competitive markets distributed over the entire country.

H. M. TAYLOR,

Agent United States Bureau of Animal Industry.

LAS VEGAS, NEW MEXICO, June 30, 1888.

NUMBER AND VALUE OF PURE-BRED CATTLE IN THE UNITED STATES.

Hon. NORMAN J. COLMAN,
United States Commissioner of Agriculture:

SIR: I have the honor of submitting herewith a statement of the results of inquiries intended to elicit information showing the numbers, ages, values, and distribution of purely-bred cattle of the several breeds established in the United States.

Letters of inquiry were sent for this purpose to every breeder of such cattle in this country, whose address could be obtained. All other available sources of information were applied to, where there seemed to be reason for supposing that more accurate or full reports than were furnished by owners of the stock could be thus gathered. The information thus obtained has been put into what seems to be the most condensed and useful form practicable.

It has been deemed best to include in the following tables a count of all animals of pure breeding reported, even though some were not registered in the herd-books. Most owners say that of the animals reported by them all are eligible to record, although some have not been so recorded.

It seems to be more than probable that the number of animals now in this country, entitled to registration in the herd-books, but not so recorded, is more than equal to the entire number of entries of pedigrees of cattle born since 1870, included in the subjoined tables, and which have since died. The demand for stock of the classes under consideration has been comparatively light during the last three or four years, and there has therefore been less inducement than there was before to record the pedigree of every calf of pure breeding. Large numbers of young bulls of that class, especially those of Shorthorn, Holstein-Friesian, and Jersey blood, have been used for breeding purposes on the plains of the West, and elsewhere, without being registered.

It has been considered advisable to include under the heading "1877," in the first column of the following tables, a count of animals born in the years 1870 to 1877, both included. The total number of such pedigrees is small, compared with that of entries in later years, and much exceeded by the number of purely-bred animals of the breeds under consideration which were never recorded. There are a few cows still in bearing that were born before 1875, and reports have been received of some which were sixteen years old when their last calves were dropped, in 1886.

It is believed that the figures given in this report furnish at least a very close approximation to the truth, if they do not show with absolute exactness the number and value of the purely-bred cattle now in the several States of the Union, together with their average

and their total values. As a rule the values quoted are under rather than over the present actual selling values of the stock. Indeed, many breeders say, when they make their reports, that the stock is really worth more than the prices they mention.

The accompanying statements illustrate accurately the beginning, rise, and in some instances the decline in popularity of the breeds represented, although a mere increase or decrease in the number of pedigrees offered for registration in any one year, for any breed, is not necessarily a true index of the number of animals of that breed born in that year. Any one of several causes may deter breeders from incurring the expense of putting pedigrees on record. One of the chief of these causes is lack of demand strong enough to take all the stock at remunerative prices; but it is evident that whenever the demand for such stock shall become active enough to insure sale at profitable figures, the pedigrees of such unregistered animals may be sent forward for registration. They would indicate an increased popularity for the breed, but would of course not show any increased productiveness of the herds. Some breeders neglect recording the pedigrees of their purely-bred stock until a desire to sell the animals makes such registration necessary. This is apparently more generally true of owners of Shorthorns than of any other race, unless it be the Ayrshires. In such cases the herd-books fail utterly to truly represent the actual number of cattle of pure breeding in the land. There is also a large number of people who never record the pedigrees of their stock in the herd-books published, but some of this class carefully keep private records of the breeding of their animals. It is beyond a doubt that more breeders of Shorthorns than of any other race do this.

The first two tables for each breed give, under appropriate headings, the number of cows and of bulls born in each State in the year represented by those columns. The first column of the third table of each set gives the total number of animals recorded of the breed represented; the second table shows the number recorded from each State; the third column shows the average of all the values put on these cattle, usually by the owners of the stock. The last column shows the total value for each State.

The figures representing the total available supply of cattle of all breeds, eligible for registration in the herd-books of this country, appear to show clearly that there are not in the whole United States enough animals of pure blood to serve fully the purpose of improving the common stock in the land; nor would there be if every calf born of these pure breeds were saved and used to its utmost capacity for breeding. The summary of bulls shows that there were last year of recorded males only 48,109, and of cattle of all breeds eligible for registration the whole number reported is only 146,639. Of these 99,638 are of a single breed.

Questions addressed to thousands of breeders, most of them careful observers who have had long experience in the live-stock business, elicited replies which show that the yield of milk by the offspring of native or unimproved cows, coupled with purely-bred bulls of dairy breeds, is from 25 to 100 per cent. greater than that from unimproved or common native stock. The general average increase of yield of milk resulting from the use of such bulls on native cows, has been, for the whole country, 55.94 per cent. The yield of butter is increased, by the same cause, 69.78 per cent., and that of cheese, 39.28 per cent.

The introduction of the blood of beef breeds, particularly of Short-horns, has improved the yield of dairy products to the following extent: Of milk, 36.74 per cent.; of butter, 29.92 per cent.; and of cheese, 18.91 per cent., where grade stock got by purely-bred bulls of the kinds mentioned have been milked.

The cost of production of beef by animals sired by Holstein-Friesian bulls coupled with cows of common stock is reported, by breeders in the different parts of the United States, to be such as would make the general average cost of beef of grade yearlings \$3.43½ per 100 pounds. The general average cost of the beef of two-year-old grades of this kind is \$3.24, and that from three-year-old grades of the same breeding, is \$3.16½ per 100 pounds. All the figures given are for living animals. In the same localities the general average cost of the beef of scrub or common yearlings is \$4.33½, that of two-year-olds was \$4.20, and that from three-year-olds was \$4.26½ per cental. These figures, based on and giving the general averages of reports received from observers scattered throughout nearly every part of the United States where bulls of pure blood have been thus used, show that there was a difference of 99.8 cents per 100 pounds in favor of yearling grades, of 96 cents in favor of two-year-old grades, and of \$1.10 per cental in favor of three-year-old grades, compared with unimproved stock, for the production of beef.

Figures given in the table in which are contrasted the general average values of cows and bulls of pure breeding, those of grades, and those of native stock, show that while the general average value of pure-blooded cows was \$212.15, and of bulls of like breeding was \$146.34, that of half-breeds was \$36.92, that of three-quarter breeds was \$54.62, and that of all higher grades, including those which were in everything, excepting eligibility to registration and the fixity of the power of transmitting their own good qualities, seemingly as good as those of pure breeding, was \$78.75 per head. While the difference in values between the classes mentioned above was large, that between the values of the grades and the natives was equally worthy of note. Half-breeds were worth \$24.31 more than yearlings, \$17.34 more than two-year-old, and \$8.33 more than three-year-old natives. Three-quarter blood grades were worth \$42.01 more than native yearlings, \$35.04 more than two-year-old, and \$26.03 more than three-year-old natives. Higher grades averaged in value \$66.14 more than natives one year old, \$59.17 more than two-year-olds, and \$50.16 more than the value of three-year-old stock of common blood.

Another difference appears in favor of high breeding when comparison is made between the percentage of calves, born of the several classes of cows, which reach maturity. Of those from cows of pure breeding 88.17 per cent. reach mature or breeding age. Of grade calves 66.32 per cent. arrive at that stage, while of native calves born only 52.87 per cent. become old enough to breed. In obtaining these figures those animals which are killed for veal are not counted.

The general average duration of life of native bulls has been 6.48 years; that of grade bulls has been 6.91 years, and that of bulls of pure breeding, has been 7.8 years. Native cows have lived an average life of 10.14 years; grade cows, 11.67 years, and purely-bred cows have averaged 12.64 years of life, during 85.41 per cent. of which time they have given birth to one calf each year, an average of 10.79 calves per cow during her life-time.

Using the above figures as a basis for calculations there should be no difficulty in arriving at the actual cash value of the influence of pure blood among the cattle of this country. There is good reason for believing that while the breeders who kindly made reports regarding the comparative value of stock took into consideration the better quality of the beef produced, through the use of good bulls, they did not generally take into account the higher value of the dairy products, arising from improvement in the stock yielding those products; therefore, it is safe to assume that the figures presented herewith understate rather than overestimate the difference in favor of high breeding.

Aberdeen-Angus cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Total.
California.....				10	6		6	3		25
Colorado.....				2	1	3	2	7	2	17
Dakota.....			1	11	1	1			2	16
Illinois.....	7	12	13	38	62	19	49	54	29	283
Indiana.....		3	4	14	10	13	9	12	4	69
Iowa.....		1	1	4	5	12	6	8	5	42
Kansas.....	3	1	13	17	9	21	10	25	19	118
Maryland.....				5				1	2	8
Massachusetts.....					1					1
Michigan.....	1			4	7	4	3	1		20
Minnesota.....		2		4	2	2	2	5	3	20
Missouri.....	3	9	17	38	27	42	44	44	42	266
Montana.....				5	3	3	2	2		15
Nebraska.....			2	1	6	6	12	12	2	41
New Jersey.....			5	5		5	3	2		20
New Mexico.....			1	2	9	1		6		19
New York.....		3	3	2	2	6	11	10	4	41
Ohio.....		3	3	8	1	3	6	10	1	35
Oregon.....						1			2	3
Washington.....								1		1
Totals.....	14	34	63	170	152	142	165	203	117	1,060

Aberdeen-Angus bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Total.
California.....				1				3		4
Colorado.....				1	1	6	4	3	1	16
Connecticut.....			1							1
Dakota.....			1		1	2	1		2	7
Illinois.....		1	2	2	4	11	30	36	17	103
Indiana.....				3	2	2	4	13	5	29
Iowa.....	1			2	3	12	35	18	5	76
Kansas.....		1	3	3	12	18	18	28	12	90
Kentucky.....							2			2
Maryland.....				1		1	4	3	2	11
Massachusetts.....					1					1
Michigan.....							3			3
Minnesota.....				1	1	1	1	3	1	8
Missouri.....		1	1	7	11	14	33	42	39	148
Montana.....				7	4	3	2			13
Nebraska.....					1	8	6	5	1	19
New Jersey.....				1						10
New Mexico.....							2	3		5
New York.....		1		2		1	1	7	5	17
Ohio.....				1	3	2	2	3	5	16
Oregon.....						1		1	1	3
Pennsylvania.....							1			1
Wisconsin.....						1	4	1		6
Wyoming.....						2	2	3	1	8
Totals.....	1	4	8	25	51	89	150	172	97	597

Aberdeen-Angus.

States.	Number recorded.	Number reported.	Average value.	Total value.
California.....	29	45	\$300.00	\$13,500
Colorado.....	33	92	306.52	28,200
Connecticut.....	1	5	500.00	2,500
Dakota.....	23	125	201.60	25,200
Illinois.....	386	266	279.42	74,080
Indiana.....	98	3	383.33	1,150
Iowa.....	118	170	286.03	48,625
Kansas.....	208	313	249.84	78,100
Kentucky.....	2	.....	350.00	700
Maryland.....	19	.....	.....	.....
Massachusetts.....	2	25	328.00	8,212
Michigan.....	23	58	277.59	16,100
Minnesota.....	28	34	261.77	8,900
Missouri.....	414	191	432.45	82,600
Montana.....	28	120	220.83	26,500
Nebraska.....	60	7	585.71	4,100
New Jersey.....	30	35	277.14	9,700
New Mexico.....	24	12	250.00	3,000
New York.....	58	74	236.49	17,500
Ohio.....	51	101	257.42	26,000
Oregon.....	6	37	240.54	9,900
Pennsylvania.....	1	9	488.88	4,400
Washington.....	1	60	400.00	24,000
Wisconsin.....	6	6	350.00	2,100
Wyoming.....	8	8	325.00	2,600
Totals.....	1,657	1,796	288.22	517,647

Ayrshire cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Totals.
Alabama.....	7	.....	1	2	1	.....	1	3	1	.....	16
California.....	16	.....	4	3	8	7	4	6	5	.....	53
Colorado.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
Connecticut.....	89	33	30	34	21	10	11	9	18	4	295
Delaware.....	.....	.....	.....	.....	.....	.....	2	3	.....	6	11
Georgia.....	4	1	.....	.....	3	.....	.....	.....	.....	.....	8
Illinois.....	17	11	30	21	20	14	6	12	15	8	154
Indiana.....	.....	.....	.....	1	.....	1	2	.....	.....	.....	4
Iowa.....	5	2	.....	1	1	1	1	3	1	.....	15
Kansas.....	5	.....	1	2	.....	.....	.....	.....	.....	.....	8
Louisiana.....	.....	.....	.....	.....	3	.....	.....	1	.....	.....	4
Maine.....	20	5	4	4	6	5	3	2	.....	6	55
Maryland.....	16	16	6	12	7	9	11	7	.....	2	86
Massachusetts.....	237	74	92	93	77	76	60	61	60	30	860
Michigan.....	7	4	2	2	2	6	8	2	1	1	35
Minnesota.....	13	.....	.....	.....	.....	.....	.....	.....	.....	.....	13
Mississippi.....	3	1	1	4	2	5	4	.....	1	.....	21
Missouri.....	.....	.....	.....	1	1	.....	.....	.....	.....	.....	2
Nebraska.....	.....	.....	.....	.....	1	1	.....	.....	.....	.....	4
New Hampshire.....	53	19	19	8	20	8	11	9	12	13	172
New Jersey.....	45	14	21	7	11	18	14	14	21	12	177
New York.....	377	143	136	139	141	184	160	195	122	63	1,600
North Carolina.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
Ohio.....	78	40	35	28	42	28	28	38	19	13	359
Oregon.....	1	.....	1	2	2	1	.....	.....	.....	.....	7
Pennsylvania.....	49	32	37	38	35	34	42	52	24	29	372
Rhode Island.....	160	41	34	30	22	28	18	24	35	22	414
South Carolina.....	2	1	2	3	3	7	7	14	4	3	46
Texas.....	1	1	.....	.....	1	.....	.....	.....	.....	.....	3
Vermont.....	92	31	23	31	19	9	22	27	22	20	295
Virginia.....	4	.....	.....	1	.....	.....	3	1	1	2	12
Wisconsin.....	23	6	3	4	9	3	2	3	1	.....	54
Totals.....	1,324	476	481	481	460	461	422	486	369	228	5,188

Ayrshire bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Totals.
Alabama	3					2	3	4			12
Arizona								1			1
California	4		2	3	2	5	7	4			27
Colorado				1						1	2
Connecticut	44	13	17	16	13	7	11	8	2	6	137
Delaware		1				2	1	1	5		10
Georgia			1		1		1	1			4
Illinois	13	6	4	3	13	2	4	5	2	2	54
Indiana					2	1	1	5			9
Iowa	2			1		3	3	3	3		15
Kansas	4			1	1						6
Maine	12	3	3				4	4	3	1	30
Maryland	9	3	2	1	1	2	3	2	3		26
Massachusetts	84	45	64	38	25	22	16	19	16	8	337
Michigan	10	3	6	1	3	3	2	2			30
Minnesota	2										2
Mississippi	5		1	3	1	1	3	1			15
Missouri					1	1			1		3
Nebraska						1	1	1	1		4
New Hampshire	18	6	5	5	3	1	4	1	2	1	46
New Jersey	11	7	6	3	2	12	11	15	12	6	85
New Mexico								1			1
New York	134	68	67	58	47	74	63	57	48	19	635
North Carolina	1										1
Ohio	60	21	23	16	17	10	14	16	9	1	186
Oregon						2					5
Pennsylvania	38	24	12	22	18	32	41	32	17	8	244
Rhode Island	58	18	17	5	6	7	5	2	5	3	126
South Carolina	1	2	1	2	4	3	4	3	5	2	27
Tennessee		1									1
Vermont	47	12	9	14	9	17	13	13	13	11	158
Virginia	6	2		1			1	1	2	2	15
West Virginia				1			1				2
Wisconsin	11	5	4	1	1		3	2	1		28
Totals	577	240	248	196	171	210	220	204	152	71	2,284

Ayrshires.

States.	Number recorded.	Number reported.	Average value.	Total value.
Alabama	28	17	\$76.00	\$1,290
Arizona	1			
California	80	55	220.00	12,210
Colorado	3			
Connecticut	402	436	83.82	36,545
Delaware	21	18	94.17	1,695
Georgia	12	15	85.00	1,275
Illinois	208	263	65.97	17,350
Indiana	13	6	250.00	1,500
Iowa	30	39	145.50	5,675
Kansas	14	10	98.70	985
Louisiana	4			
Maine	85	46	83.33	3,830
Maryland	112	23	99.64	2,790
Massachusetts	1,197	1,235	89.18	110,135
Michigan	65	32	94.61	3,125
Minnesota	15	18	102.50	1,845
Mississippi	36	20	80.00	1,600
Missouri	5	11	49.09	540
Nebraska	8			
New Hampshire	218	78	102.05	7,960
New Jersey	262	255	91.36	23,295
New York	2,295	1,425	105.57	150,555
Ohio	545	172	93.31	16,060
Oregon	12	25	80.00	2,000
Pennsylvania	616	256	98.26	25,155
Rhode Island	540	196	96.12	17,880
South Carolina	73	48	125.00	6,000
Vermont	453	313	130.38	40,810
Virginia	27	17	75.00	1,275
Wisconsin	82	22	87.50	1,925
Totals	7,462	5,048	98.12	495,305

Devon cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	Total.
Alabama							2	2	5	3		12
Arkansas								1	1			2
California	1	2	5	1	2	9	2	10	7	15	4	61
Colorado					1	1	1	3	10	6		19
Connecticut	230	60	51	42	35	43	41	60	52	67	12	693
Dakota							3		3	1	3	11
Delaware								1				1
Georgia						1						1
Illinois	37	12	17	15	10	16	16	14	14	6	1	158
Indiana				1	2	4	2	6	11	9		35
Iowa	9	6	5	2	8	8	9	2	1	6		56
Kansas			2	3	4	9	8	4	5	1	1	37
Kentucky									3	6		9
Louisiana				1	1	1	4	2	3			12
Maine							1		2			6
Maryland	12	3		1	1	11	4	3	2			37
Massachusetts	40	12	12	11	11	2	9	16	6			119
Michigan	54	18	14	9	20	21	18	14	16	5	1	190
Minnesota									1	1		3
Mississippi							2	7	11	20	2	42
Missouri	2		2	2	2	1	7	4	4	9	2	35
Nebraska	6	2	7	5	4	5	2			2		33
New Hampshire	29	23	16	13	9	9	9	11	15	8	1	143
New Jersey									1	2	1	5
New York	142	49	57	54	67	77	90	31	63	59	12	701
North Carolina	1			1					8	3	1	17
Ohio	94	34	52	62	71	73	84	96	97	70	14	747
Pennsylvania	54	27	29	30	35	39	52	64	79	64	11	484
Rhode Island	1	1	4	6	2	2	6	1	1			24
South Carolina	3		2	4		1	2	1	8		4	26
Tennessee		3	7	10	7	16	7	35	29	41	15	170
Texas								1	6	2		9
Utah					2	6	3	2	4			17
Vermont	22	10	13	12	12	18	30	31	29	36	2	215
Virginia	10	3	5	3	4	7	11	11	6	7		67
West Virginia	2	3	2	3	2	1	11	6	3	4		37
Wisconsin	37	18	17	16	31	26	16	25	24	32		242
Wyoming	2											2
Totals	791	286	319	308	345	407	452	467	523	493	87	4,478

Devon bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	Total.
Alabama								3	3	5		11
Arkansas								2				2
California	2		1			7	1	3	10	11		35
Colorado					1	2	3	6	12	4	1	29
Connecticut	79	43	31	22	27	24	24	24	31	44	2	351
Dakota							3	2	2	2		9
Delaware								2	1			3
Florida									1			1
Georgia								1	1			2
Illinois	16	9	8	7	10	14	17	5	7	3		96
Indiana					1	1	3	10	4	6	1	26
Iowa	6	1	2	2	4	7	4	9	2	6		43
Kansas		1		1	4	2	5	6	1			20
Kentucky									4	6		10
Louisiana		1					2	4	2	5	1	15
Maine									2	2		4
Maryland	3	7		1		1	2		3	1		13
Massachusetts	21	4	6	4	7	3	3	11	5	3		67
Michigan	26	6	6	7	5	10	13	9	6	5		93
Minnesota	1							1	4	3		9
Mississippi	1				1	1	1	6	10	9		23
Missouri	1				1	1	3	4	7	5		22
Nebraska	3	5	6	1	2				2			19
New Hampshire	17	8	8	5	10	5	7	9	3	1		73
New Jersey	1								1	1		3
New York	65	34	41	44	44	50	58	46	43	41		466
North Carolina				1		2	1	3	7	4		18
Ohio	52	30	35	38	30	47	60	61	53	30		463
Pennsylvania	19	14	19	18	22	19	7	33	45	47	6	254
Rhode Island	2				1		2	3	2			10
South Carolina	1						1	2	5	4		13
Tennessee		4	3	4	10	12	17	18	33	22	13	136
Texas								2	2	2		6
Utah							1		4			5
Vermont	8	12	11	7	13	12	11	16	17	32	8	147
Virginia	1	1	2	1	2	3	7	5	2	3		27
West Virginia	1					1	4	3	4	5		18
Wisconsin	13	11	12	13	15	27	16	25	23	27	1	183
Totals	339	200	191	176	209	251	285	339	364	348	33	2,735

Devons.

States.	Number recorded.	Number reported.	Average value.	Total value.
Alabama.....	23	39	\$79.48	\$3,100
Arkansas.....	4	9	100.00	900
California.....	96	85	188.29	16,705
Colorado.....	48	48	100.00	4,800
Connecticut.....	1,044	590	94.82	50,255
Dakota.....	20	20	75.00	1,500
Delaware.....	4			
Georgia.....	3	10	100.00	1,000
Illinois.....	254	135	113.26	15,290
Indiana.....	61	49	88.77	4,310
Iowa.....	99	102	75.00	7,650
Kansas.....	57	39	55.10	2,150
Kentucky.....	19	24	61.25	1,470
Louisiana.....	27	24	114.50	2,750
Maine.....	10	6	75.00	450
Maryland.....	55	1		60
Massachusetts.....	186	127	44.81	5,735
Michigan.....	283	70	174.92	12,244
Minnesota.....	12	6	108.33	650
Mississippi.....	69	14	130.35	1,825
Missouri.....	57	37	88.10	3,260
Nebraska.....	52	13	91.06	1,185
New Hampshire.....	216	51	65.39	3,335
New Jersey.....	8			
New York.....	1,167	968	127.23	123,165
North Carolina.....	35	27	63.50	1,715
Ohio.....	1,210	750	55.02	40,265
Pennsylvania.....	799	331	95.00	31,410
Rhode Island.....	34	55	76.36	4,200
South Carolina.....	39	29	66.60	1,930
Tennessee.....	306	265	75.42	19,985
Texas.....	15			
Utah.....	22	17	105.00	1,785
Vermont.....	362	267	76.63	20,460
Virginia.....	94	68	56.65	3,820
West Virginia.....	55	36	37.50	1,350
Wisconsin.....	425	228	96.49	22,000
Totals.....	7,210	4,480	92.13	412,739

Galloway cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Total.
California.....					2		9	6		17
Colorado.....				3	6	3	1	8	4	25
Dakota.....								1		1
Idaho.....								2		2
Illinois.....	2			10	12	1	10	21	7	63
Indiana.....								1		2
Iowa.....				2	5	19	2	11	3	42
Kansas.....				5	16	15	7	20	14	77
Kentucky.....						1				1
Maryland.....						1				1
Michigan.....	3	2	2	13	19	17	16	29	9	110
Minnesota.....						3		1		4
Mississippi.....	1		1	1						3
Missouri.....	3	2	7	64	192	57	27	100	15	467
Nebraska.....	1	1		3	10	1	2	6	1	25
New Mexico.....	1			4	25	8	1	9		47
New York.....					3	10			5	18
Ohio.....	7		1			2	1	2		13
Pennsylvania.....	1			1	1	1				4
Texas.....							1	1		1
West Virginia.....										1
Wisconsin.....				13	13	6	9	11	16	68
Totals.....	18	5	11	119	304	145	87	229	74	992

Galloway bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Total.
California.....					1		5	1	1	8
Colorado.....	1			2		2		5	6	20
Dakota.....							1			1
Idaho.....							2	1		3
Illinois.....					4	3	19	24	3	53
Indiana.....					1	1	1	1		4
Iowa.....				2	1	6	11	19	4	41
Kansas.....				2	2	19	17	37	8	85
Maryland.....				1		1				2
Massachusetts.....						1				1
Michigan.....	1			9	2	9	13	19	10	63
Mississippi.....	1			3	7	2				13
Minnesota.....								1		1
Missouri.....		1		11	25	52	103	120	36	348
Nebraska.....				1	1	7		5	3	17
New Hampshire.....								2		2
New Mexico.....								11		11
New York.....									6	6
Ohio.....	2				1	3		2	1	9
Pennsylvania.....									4	4
Texas.....								1		1
Vermont.....						1				1
Wisconsin.....				4	7	4	8	8	15	46
Totals.....	5	1		33	52	111	184	261	93	740

Galloways.

States.	Number recorded.	Number reported.	Average value.	Total value.
California.....	25	45	\$300.00	\$13,500
Colorado.....	45	60	275.00	16,500
Dakota.....	2	4	135.00	780
Idaho.....	5	7	200.00	1,400
Illinois.....	116	163	195.00	32,760
Indiana.....	6	11	110.00	1,210
Iowa.....	83	124	100.00	12,400
Kansas.....	162	194	222.48	20,910
Kentucky.....	1	1		125
Maryland.....	3	4	203.00	812
Massachusetts.....	1	3	155.00	465
Michigan.....	173	183	173.62	31,774
Minnesota.....	5	15	234.00	2,010
Mississippi.....	16		95.00	1,520
Missouri.....	815	601	165.00	99,165
Nebraska.....	42	38	163.23	6,023
New Hampshire.....	2			230
New Mexico.....	58	154	220.39	23,940
New York.....	24	24	187.65	6,880
Ohio.....	22	42	87.50	3,675
Pennsylvania.....	8	21	147.62	3,100
Texas.....	2			320
Vermont.....	1			250
West Virginia.....	1			200
Wisconsin.....	114	146	235.82	53,295
Totals.....	1,732	1,855	184.76	342,746

Hereford cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Total.
Colorado	8	2	.....	4	8	16	13	4	.....	.....	55
Connecticut .....	.....	.....	.....	1	.....	.....	1	.....	.....	.....	2
Dakota .....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
Illinois	149	68	73	131	190	297	237	157	2	.....	1,804
Indiana	27	20	16	102	75	100	138	59	.....	.....	537
Iowa	24	42	20	13	40	29	23	24	.....	.....	215
Kansas	11	6	6	9	13	16	25	14	.....	.....	100
Kentucky .....	.....	.....	.....	1	.....	1	9	1	.....	.....	12
Maine	28	6	5	3	1	3	2	.....	.....	.....	48
Maryland	14	2	3	2	2	6	9	3	.....	.....	41
Michigan .....	.....	.....	4	19	28	32	36	17	.....	.....	136
Missouri	6	3	6	28	20	58	55	23	.....	.....	208
Montana .....	.....	.....	.....	.....	2	.....	2	.....	.....	.....	4
Nebraska .....	.....	.....	1	1	.....	7	15	9	.....	.....	33
Nevada	1	8	.....	1	6	3	9	6	.....	.....	34
New Hampshire .....	.....	1	1	1	2	1	.....	.....	.....	.....	6
New York .....	.....	.....	.....	3	.....	.....	2	1	.....	.....	6
Ohio	48	22	26	46	27	65	60	55	.....	.....	349
Pennsylvania	1	1	.....	2	3	2	2	.....	.....	.....	11
Texas .....	.....	1	.....	.....	.....	1	.....	.....	.....	.....	2
Vermont .....	.....	.....	.....	4	1	.....	4	.....	.....	.....	9
West Virginia .....	.....	.....	.....	2	3	.....	.....	1	.....	.....	6
Wisconsin .....	.....	.....	.....	.....	.....	4	.....	.....	.....	.....	4
Totals	317	182	161	373	431	641	642	374	2	.....	3,123

Hereford bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Total.
Colorado	55	4	.....	5	6	10	19	4	.....	.....	103
Connecticut .....	.....	.....	.....	.....	.....	1	1	1	.....	.....	3
Dakota .....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	1
Illinois	50	17	29	107	123	175	235	219	.....	.....	955
Indiana	2	2	9	20	21	58	97	49	.....	.....	258
Iowa	6	12	25	6	15	40	39	16	1	.....	160
Kansas	3	5	1	7	12	20	67	19	.....	.....	134
Kentucky .....	.....	.....	.....	.....	.....	.....	4	.....	.....	.....	4
Maine	7	6	.....	3	1	5	.....	1	.....	.....	23
Maryland	1	1	.....	.....	1	.....	3	6	.....	.....	12
Massachusetts .....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
Michigan	2	1	.....	6	8	29	37	44	.....	.....	127
Minnesota .....	.....	.....	1	1	1	5	3	.....	.....	.....	11
Missouri	3	1	1	13	20	55	82	31	1	.....	207
Montana .....	.....	.....	4	.....	.....	1	1	.....	.....	.....	6
Nebraska .....	.....	.....	.....	.....	2	1	11	7	.....	.....	21
Nevada .....	.....	.....	.....	.....	.....	4	3	3	.....	.....	10
New Hampshire .....	.....	.....	.....	2	4	1	.....	.....	.....	.....	7
New Mexico	1	1	.....	2	2	.....	3	2	.....	.....	6
New York	1	.....	.....	1	.....	5	.....	.....	.....	.....	12
Ohio	4	5	2	12	25	40	40	39	.....	.....	167
Pennsylvania .....	.....	.....	1	.....	.....	.....	3	.....	.....	.....	4
Texas	11	1	.....	.....	3	3	4	2	.....	.....	24
Utah .....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
Vermont .....	.....	.....	.....	.....	1	.....	.....	3	.....	.....	5
West Virginia .....	.....	.....	.....	.....	.....	1	1	.....	.....	.....	2
Wisconsin .....	.....	.....	.....	.....	.....	1	1	7	.....	.....	9
Wyoming	41	23	4	26	33	2	1	1	.....	.....	131
Totals	187	80	77	212	279	458	655	454	2	.....	2,404

Herefords.

States.	Number recorded.	Number reported.	Average value.	Total value.
California.....		6	\$250.00	\$1,500
Colorado.....	158	843	208.00	169,150
Connecticut.....	5	39	138.46	5,400
Dakota.....	2	156	147.43	23,000
Idaho.....		8	225.00	1,800
Illinois.....	2,259	1,409	295.71	409,670
Indiana.....	795	477	395.16	149,075
Iowa.....	375	715	256.74	183,575
Kansas.....	234	651	281.68	183,375
Kentucky.....	16	25	248.00	6,200
Maine.....	71	151	225.00	33,975
Maryland.....	53	22	130.00	2,860
Massachusetts.....	1			
Michigan.....	263	411	206.57	84,900
Minnesota.....	11	52	300.67	15,950
Missouri.....	415	849	231.26	111,575
Montana.....	10	38	240.00	9,100
Nebraska.....	54	279	278.93	78,100
Nevada.....	44			
New Hampshire.....	13			
New Mexico.....	6	24	200.00	4,800
New York.....	18	494	198.60	98,800
Ohio.....	516	475	183.85	87,350
Pennsylvania.....	15	18	183.33	3,300
Oregon.....		2	200.00	400
Texas.....	26	17	417.65	7,160
Utah.....	1	25	320.00	8,000
Vermont.....	14	42	233.33	15,000
Washington.....		16	236.00	3,775
West Virginia.....	8	14	200.00	2,800
Wisconsin.....	13	26	300.00	7,800
Wyoming.....	132	122	300.00	36,600
Totals.....	5,526	7,409	234.52	1,744,930

Guernsey cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Total.
California.....	2	9	2	1	1	1	4	3	2	.....	25
Colorado.....								1			1
Connecticut.....	72	16	21	26	28	31	30	36	30	3	293
Delaware.....	2	1		2	1	2	3	1			12
Georgia.....			1			3		1			5
Illinois.....	1		1	3	13	6	10	13	3		50
Iowa.....						2					2
Kansas.....						1	2	1	1		5
Kentucky.....								1	1		2
Maine.....			2	1	2	1	4	1	1		12
Maryland.....	2	5	2	6	1	4	4	6	5		35
Massachusetts.....	42	16	28	43	57	55	52	62	66	10	431
Michigan.....							4				4
Missouri.....						3		1			1
Nebraska.....			1	1	1	3	6	2	1		15
New Hampshire.....			1	1		1			1	1	5
New Jersey.....	6	2	7	8	4	4	11	23	31	7	103
New York.....	37	19	22	34	59	70	82	50	45	11	429
North Carolina.....							3		4	1	8
Ohio.....	4		3	3	9	3	2	4	1		29
Oregon.....					1	1	2	3	5		12
Pennsylvania.....	88	48	73	95	139	129	115	112	100	16	915
Rhode Island.....	1				1			9	4		15
South Carolina.....			1			5	1	3			10
Vermont.....	6	2	3	6	3	1	1		4		22
Virginia.....	1	4	2			4	2		4	2	19
West Virginia.....								2	1		3
Wisconsin.....	1	8	9	4	11	13	5	9	5		65
Totals.....	265	130	179	234	331	338	345	344	311	51	2,528

Guernsey bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Totals.
Alabama	1										1
California		1		1	1	2	3				8
Connecticut	16	16	13	13	13	20	16	16	6		129
Delaware		1			1		2				4
Georgia	2				1	1	1	1			6
Illinois				1	6	5	6	6	4		28
Indiana							1	1			2
Iowa							2				2
Kansas								2			2
Kentucky							1	1			2
Maine				1	2	2	3	1			9
Maryland					2	4	6	4	6		22
Massachusetts	27	10	13	13	19	31	48	45	15		221
Michigan					1	4	1	3			9
Minnesota					1			1	2		4
New Hampshire		1				2					3
New York	15	8	19	12	22	25	35	31	14		181
New Jersey	3	1	2	2	4	6	4	14	8	1	45
Nebraska			1				2	2	1		8
North Carolina						1	2	2	5		10
Ohio		1			2		6	4	1		14
Oregon						1		1	1		3
Pennsylvania	39	11	15	37	54	46	79	98	42	1	422
South Carolina						2		2			5
Vermont	2	3	3	2	5	3	4	1	2		25
Wisconsin					1	4	5	5	3		18
Totals	105	53	66	82	135	159	229	241	111	2	1,183

Guernseys.

States.	Number recorded.	Number reported.	Average value.	Total value.
Alabama	1			\$225
California	33		\$227.00	7,491
Colorado	1	3	210.00	630
Connecticut	422	372	138.38	51,440
Delaware	16	26	115.38	3,000
Georgia	11	13	88.82	1,155
Illinois	78	96	112.50	10,800
Indiana	2			265
Iowa	4			225
Kansas	7	3	266.66	800
Kentucky	4		156.00	624
Maine	21	26	66.92	1,740
Maryland	57	80	55.50	4,440
Massachusetts	652	812	58.20	47,258
Michigan	13	11	156.81	1,725
Minnesota	4	5	100.00	500
Missouri	1	4	125.00	500
Nebraska	23	21	255.50	5,865
New Hampshire	8	3	150.00	450
New Jersey	143	78	199.42	15,555
New York	610	1,057	201.41	212,890
North Carolina	18	21	86.45	1,515
Ohio	43	55	165.00	9,075
Oregon	15	26	234.61	6,100
Pennsylvania	1,337	1,499	132.29	190,365
Rhode Island	15	6	200.00	1,200
South Carolina	15	10	76.48	765
Vermont	47	26	88.25	2,295
Virginia	19	18	87.50	1,575
West Virginia	3		85.70	257
Wisconsin	63	97	113.30	10,990
Totals	3,711	4,308	137.30	591,515

Holstein-Friesian cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Totals.
Alabama										1	1
Arkansas									2		2
California	2	1	1	3	5	2	6	10	39	64	133
Colorado	1	1	1	3			2	4	8	12	32
Connecticut		1	1	3	5	19	75	83	93	115	395
Dakota								1		23	24
Delaware										3	3
Georgia			1			1				2	4
Idaho							3	2	4	4	13
Illinois	22	29	49	53	135	170	352	335	320	159	1,624
Indiana	2			3	2	8	15	23	30	54	137
Iowa	6	6	10	40	60	98	156	159	159	149	843
Kansas				7	3	5	14	14	44	53	140
Kentucky		3	12	5	9	6	91	158	84	87	455
Louisiana								4	5	1	10
Maine		2	1	5	1	3	1	4	6	9	32
Maryland									4	12	16
Massachusetts	23	29	65	58	87	203	414	273	238	160	1,540
Michigan	2	3	13	15	32	84	87	132	202	207	777
Minnesota		2	1	3	4	1	28	54	121	102	316
Mississippi						4	9	14	7	19	53
Missouri					1		2	18	48	39	108
Montana			1						2	13	16
Nebraska		4		1		1	4		3	14	27
Nevada									1		1
New Hampshire		1		1	4		62	30	6	21	125
New Jersey	3	1	5	8	16	9	59	19	63	48	231
New Mexico									1	1	2
New York	34	131	162	160	274	795	1,308	798	715	774	5,251
North Carolina										1	1
Ohio	4	13	12	8	10	194	253	188	209	219	1,110
Oregon	1		1			2	2	1	1	4	12
Pennsylvania	20	9	18	49	93	140	319	182	272	244	1,546
Rhode Island	3		1		1		2	3	7	6	23
South Carolina			1	1	4	2	4	5	3	16	36
Tennessee					1	1	6	107	53	55	223
Texas					1		1	1	2	2	7
Utah									5	12	17
Vermont		2	1	5	6	5	16	20	34	39	128
Virginia	8	16	9	1	12	15	14	15	20	19	129
Washington										12	12
West Virginia								1	6	7	14
Wisconsin	3	2	9	9	21	15	24	36	79	124	322
Wyoming									1		1
Totals	134	256	375	441	787	1,783	3,419	2,694	2,897	2,906	15,632

Holstein-Friesian bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Total.
Alabama										1	1
Arkansas									1		1
California	1		1	2	1	5	3	11	42	46	112
Colorado				1		2	3	4	10	5	25
Connecticut	1	2			7	10	24	46	78	73	241
Dakota								1	6	2	9
Delaware		1							1	2	4
Idaho							2	5	3	6	16
Illinois	29	28	25	28	47	83	178	229	302	240	1,189
Indiana	1	2	1	2			8	18	42	58	133
Iowa	5	2	5	21	25	46	91	120	158	153	626
Kansas	1		2	1	7	13	15	103	41	43	226
Kentucky			1	2	7	9	13	29	105	45	211
Louisiana								3	1	1	5
Maine	7	1	3	2	3	5	4		4	2	31
Maryland					1	1	1		4	13	20
Massachusetts	30	8	17	11	31	56	61	104	143	135	596
Michigan	3	2	3	11	22	28	54	99	168	141	531
Minnesota	1	1		4	6	6	25	48	103	103	297
Mississippi	1					1	5	6	12	11	35
Missouri						1	3	22	43	38	107
Montana								1	5	9	15
Nebraska		2		1	1	1	1	6	17	18	47
Nevada							1			2	3
New Hampshire		1					1	4	8	23	42

Holstein-Friesian bulls—Continued.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Total.
New Jersey	4	3	1	2	5	12	17	33	38	39	154
New York	62	42	60	92	140	235	359	441	692	685	2,808
North Carolina										8	3
Ohio	1	3	3	9	13	32	58	117	183	183	602
Oregon	1	1					1	3	5	5	16
Pennsylvania	15	5	21	22	19	27	16	106	196	177	604
Rhode Island	2	1			1	1	6	9	7	6	33
South Carolina		1		1		2	4	2	11	8	29
Tennessee						3	8	27	52	47	137
Texas								2	3	2	7
Utah									3	13	16
Vermont	8	2	2	4	4	5	13	28	30	38	134
Virginia	2	3	8	2	11	17	13	20	22	19	117
Washington									2	11	13
West Virginia									4	6	10
Wisconsin	5	7	4	9	7	10	33	51	61	107	294
Totals	179	118	157	227	358	612	1,021	1,698	2,006	2,524	9,500

Holstein-Friesians.

States.	Number recorded.	Number reported.	Average value.	Total values.
Alabama	2	7	\$92.86	\$650
Arkansas	3	11	105.00	1,155
California	245	351	115.90	40,680
Colorado	57	65	175.00	11,375
Connecticut	636	505	105.56	62,808
Dakota	33	53	165.50	8,770
Delaware	7			
Georgia	4	7	135.00	945
Idaho	29	25	145.00	3,625
Illinois	2,813	2,515	152.78	384,242
Indiana	270	210	102.88	21,605
Iowa	1,469	1,350	117.80	159,030
Kansas	366	309	245.46	75,847
Kentucky	666	604	103.45	62,485
Louisiana	15	7	125.65	880
Maine	63	92	100.00	9,200
Maryland	36	42	129.17	5,425
Massachusetts	2,196	2,140	160.24	342,715
Michigan	1,808	1,778	172.10	305,995
Minnesota	613	703	187.00	148,290
Mississippi	88	122	126.82	16,105
Missouri	215	205	183.92	54,255
Montana	31	11	271.82	3,000
Nebraska	74	99	314.68	31,155
Nevada	4	8	187.55	1,500
New Hampshire	167	268	205.50	55,100
New Jersey	385	435	172.00	74,820
New Mexico	2			
New York	8,049	8,367	199.17	1,666,455
North Carolina	4		97.50	380
Ohio	1,712	2,230	173.21	386,235
Oregon	28	35	208.47	7,120
Pennsylvania	1,950	2,168	126.41	274,250
Rhode Island	56	33	125.00	4,125
South Carolina	65	43	98.00	4,235
Tennessee	360	127	200.00	25,400
Texas	14		187.80	2,630
Utah	33	45	333.33	15,000
Vermont	262	263	185.00	52,355
Virginia	246	208	124.42	33,345
Washington	25	25	283.41	7,065
West Virginia	24		85.44	2,050
Wisconsin	616	622	156.50	97,343
Wyoming	1			255
Totals	25,192	26,338	169.33	4,459,940

Red Polled cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Total.
Illinois				1	2	3	3	3	.....	12
Iowa		1	1		4		3	5	1	15
Kansas					4	5	1	2	.....	12
Kentucky							1			1
Michigan						1			2	3
Minnesota								1		1
Mississippi							1	1		2
Missouri							3			3
New York					3		1	1		5
Ohio					1					1
Pennsylvania					1	2	2	3	1	9
Vermont				2						2
Virginia						3	2	4	2	11
Wisconsin				1	1			1		3
Totals		1	1	4	16	14	17	21	6	80

Red Polled bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Total.
Illinois				1	1	2	2	2	1	9
Iowa					1		2	4	1	8
Kansas						1			1	2
Kentucky							1			1
Michigan					1		1	1		3
Missouri					1		1			2
Nebraska					1					1
New York					1	1	1	1		4
Pennsylvania				1				2	5	8
Tennessee				1						1
Vermont								1		1
Virginia						1		1		2
Wisconsin					1		1	1	2	5
Totals				3	7	5	9	13	10	47

Red Polled.

States.	Number recorded.	Number reported.	Average value.	Total value.
Illinois	21	32	\$176.41	\$5,645
Iowa	23	34	132.64	4,510
Kansas	14	23	198.70	4,570
Kentucky	2			200
Michigan	6	7	177.85	1,245
Minnesota	1			150
Mississippi	2			200
Missouri	5	8	179.37	1,435
Nebraska	1			225
New York	9	11	196.40	2,160
Ohio	1			175
Pennsylvania	17	22	148.85	3,275
Tennessee	1			
Vermont	3	5	128.50	643
Virginia	13	21	163.81	3,440
Wisconsin	8	12	199.19	2,390
Totals	127	175	167.22	30,263

Since the information was received on which the above figures are based the second volume of the Red Polled Herd-Book has been issued.

This volume shows that in July, 1887, the number and distribution of animals of this breed were as shown in the table which follows:

States.	Number recorded.	Average values.	Total values.
California	1		\$225
Dakota	2	\$215.00	430
Georgia	7	167.22	1,170
Illinois	68	176.41	11,986
Indiana	5	167.02	835
Iowa	209	182.64	38,171
Kansas	63	198.70	12,518
Kentucky	24	167.22	5,685
Massachusetts	2	159.80	320
Michigan	19	177.85	3,379
Minnesota	11	198.15	2,180
Mississippi	6	187.90	1,127
Missouri	67	179.37	12,018
Nebraska	3	255.00	615
New York	80	196.49	15,712
Ohio	47	175.00	7,860
Pennsylvania	43	148.85	6,400
Tennessee	3	167.22	502
Texas	5	167.22	836
Vermont	2	128.50	257
Virginia	20	161.81	3,276
Washington	3	185.00	585
West Virginia	1		175
Wisconsin	42	199.19	8,366
Unknown	19		3,380
Totals	762	181.10	138,098

The values given in the above table are estimated on the basis of figures given in the preceding table of the same kind, showing the distribution and values of Red Polled stock in this country.

Shorthorn cows.

States.	1877.	1878.	1879.	1890.	1881.	1882.	1883.	1884.	1885.	1886.	Totals.
Alabama							1				1
Arkansas				1	2			2			5
California	65	38	46	35	18	40	40	91	22		395
Colorado	5	8	14	11	12	22	27	35	19		153
Connecticut	30	35	13	18	1	2	2	6	7	1	115
Dakota	10	8	16	12	23	47	24	51	40	9	240
Delaware			4					2	3		9
Idaho							1	4			5
Illinois	1,348	1,353	1,682	1,449	1,158	1,461	1,261	1,518	644	64	12,038
Indiana	339	316	329	306	245	281	295	323	172	11	3,017
Iowa	940	896	1,048	1,074	1,117	1,636	1,227	1,453	544	50	10,065
Kansas	306	335	328	438	517	668	613	575	275	36	4,091
Kentucky	1,044	922	930	966	1,078	1,210	822	814	134	14	7,944
Maine	18	12	15	2	8	5	11	8	2	2	83
Maryland	18	16	26	17	24	38	36	15	6	2	198
Massachusetts	99	97	112	74	68	129	89	37	14	3	722
Michigan	255	256	269	215	128	293	371	485	338	42	2,532
Minnesota	89	86	94	72	96	149	173	224	117	4	1,104
Mississippi			3	1	4	7	6	8	14		43
Missouri	847	828	1,008	1,056	1,282	1,416	1,292	1,172	49	25	8,976
Montana	18	10	12	7	6	21	17	15	8		114
Nebraska	79	134	103	151	119	217	195	221	83	11	1,313
Nevada	12	11	7	12	14	9	23	45	2		135
New Hampshire	20	15	13	13	4	8	4	11			93
New Jersey	4	6	5	6		5	1	3	5	2	37
New Mexico								1			1
New York	232	278	230	212	147	135	240	264	100		1,698
North Carolina		1	2	2		2	2	1	5	3	18
Ohio	707	591	735	733	733	1,042	806	851	371	39	6,618
Oregon	12	7	6	8	14	17	25	28	12		129
Pennsylvania	155	147	131	184	117	204	240	371	139	18	1,707
Rhode Island	7	6	1	4	3	6	9	3			39
South Carolina					2			1			3
Tennessee	39	16	18	15	35	42	39	44	14		252
Texas	9	23	21	9	6	19	11	15	13		126
Utah	6	9						2	4		21
Vermont	64	56	64	62	25	23	26	64	27		411
Virginia	130	121	106	127	144	117	126	43	8		922
Washington	6	2	1		3	2	2	1	3		20
West Virginia	22	10	23	20	32	41	34	63	18		266
Wisconsin	172	190	178	175	130	223	272	267	129	11	1,686
Wyoming	2	1	2	5	4		1		2		17
Total	7,110	6,840	7,600	7,472	7,419	9,739	8,614	9,138	3,243	347	67,522

Shorthorn bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Totals.
Alabama.....								1			1
Arizona.....								1			1
Arkansas.....		3	1				1	7	5		17
California.....	38	30	20	14	5	10	9	62	20		218
Colorado.....	5	1	1	2	1	10	15	21	21	1	8
Dakota.....		3	4	4	8	14	23	52	48		176
Delaware.....	3		1	1					1		6
Idaho.....							3	7			12
Illinois.....	724	511	555	528	270	563	652	1,018	673	58	5,187
Indiana.....	124	119	110	96	74	165	154	299	162	15	1,818
Indian Territory.....		1									2
Iowa.....	432	346	332	362	229	452	620	1,078	774	40	4,185
Kansas.....	117	103	138	111	122	250	256	414	286	37	1,930
Kentucky.....	255	156	117	137	232	351	351	391	140	15	2,145
Louisiana.....					1	1					4
Maine.....	10	6	6	2	2	10	3	2	5		53
Maryland.....	4	2	11	8	5	8	14	14	7	1	74
Massachusetts.....	38	47	46	31	17	16	17	29	17	1	232
Michigan.....	153	174	156	136	52	174	224	269	253	27	1,687
Minnesota.....	54	55	49	51	23	57	100	158	255	5	677
Mississippi.....			2				7	11	6		26
Missouri.....	280	252	248	170	229	380	508	829	636	20	3,252
Montana.....	7	6	10	2	4	3	9	5	14		60
Nebraska.....	54	54	86	60	24	62	122	164	133	9	767
Nevada.....	2	1	1	2	2	3		1	9		21
New Hampshire.....	7	12	5	5	3	2	3	7			41
New Jersey.....	2	3	1	4	2						12
New Mexico.....		1				1					2
New York.....	167	158	100	96	38	64	97	154	82	3	968
North Carolina.....		3		4		1	2	3	3	1	17
Ohio.....	311	270	280	260	214	357	415	722	331	20	3,687
Oregon.....	6	9	7	1	1	8	9	28	14	3	86
Pennsylvania.....	90	91	84	60	31	103	143	204	149	22	977
Rhode Island.....	2	1		1							4
South Carolina.....					1				1		2
Tennessee.....	17	6	7	3	9	15	28	33	11		129
Texas.....	19	14	11	11		1	11	32	7		107
Utah.....	5	2						5	1		13
Vermont.....	50	17	25	16	3	11	21	15	15	2	178
Virginia.....	23	23	18	17	16	25	32	24	4		182
Washington.....		1	1								4
West Virginia.....	15	3	3	1	3	6	16	15	22		95
Wisconsin.....	92	123	90	75	34	95	132	230	162	9	1,042
Wyoming.....	1						1		1		3
Totals.....	3,107	2,607	2,535	2,272	1,695	3,223	4,026	6,315	3,602	289	29,671

Shorthorns.

States.	Number recorded.	Number reported.	Average value.	Total values.
Alabama.....	2	5	\$60.00	\$300
Arizona.....	1	21	265.00	5,565
Arkansas.....	22	13	54.62	710
California.....	603	546	123.46	72,880
Colorado.....	231	875	223.42	195,492
Connecticut.....	115	97	88.70	8,605
Dakota.....	396	528	109.30	56,710
Delaware.....	15	6	156.67	940
Idaho.....	17	86	175.00	15,059
Illinois.....	17,625	15,555	137.65	2,140,700
Indiana.....	4,335	3,120	139.92	436,550
Indian Territory.....	2	12	122.46	1,470
Iowa.....	14,550	16,743	113.27	1,896,500
Kansas.....	5,921	6,875	139.60	959,750
Kentucky.....	10,089	7,652	163.29	1,249,495
Louisiana.....	4		100.00	400
Maine.....	136	143	91.47	1,455
Maryland.....	272	163	196.26	27,590
Massachusetts.....	974	576	90.02	51,850
Michigan.....	4,239	4,430	122.24	540,300
Minnesota.....	1,781	2,542	175.13	410,155
Mississippi.....	69	33	159.96	5,280
Missouri.....	12,228	16,103	114.22	1,739,275
Montana.....	174	301	201.35	61,010
Nebraska.....	2,000	3,111	114.80	357,143
Nevada.....	156	264	208.85	53,815
New Hampshire.....	137	95	75.00	53,816

Shorthorns—Continued.

States.	Number recorded.	Number reported.	Average value.	Total values.
New Jersey.....	49	.....	85.00	4,165
New Mexico.....	3	321	211.09	67,760
New York.....	2,806	2,572	105.71	271,886
North Carolina.....	35	88	127.92	4,870
Ohio.....	9,705	8,975	138.89	1,245,730
Oregon.....	215	376	208.11	78,250
Pennsylvania.....	2,634	2,375	115.03	273,196
Rhode Island.....	43	.....	92.55	3,980
South Carolina.....	5	.....	132.50	665
Tennessee.....	381	325	113.13	26,880
Texas.....	233	465	142.72	66,365
Utah.....	34	41	221.43	9,300
Vermont.....	589	493	63.60	3,382
Virginia.....	1,104	1,002	74.13	74,535
Washington.....	24	71	201.50	14,305
West Virginia.....	361	279	126.72	35,355
Wisconsin.....	2,728	2,581	136.95	853,390
Wyoming.....	20	38	188.71	7,170
Totals.....	96,193	99,638	119.37	12,893,990

Swiss cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	Total.
Colorado.....	1	.....	3	1	.....	1	.....	.....	6
Connecticut.....	5	4	6	23	12	13	22	11	96
Illinois.....	.....	.....	.....	1	3	.....	2	.....	7
Iowa.....	.....	.....	1	1	.....	.....	.....	.....	2
Maine.....	1	.....	.....	1	.....	.....	.....	.....	2
Massachusetts.....	14	7	16	7	9	7	8	5	73
New York.....	1	2	1	5	10	11	2	7	39
Pennsylvania.....	4	1	1	2	1	3	3	2	17
Totals.....	26	14	28	41	35	35	37	26	242

Swiss bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Total.
Colorado.....	2	.....	.....	.....	2	2	1	.....	.....	7
Connecticut.....	4	3	3	6	10	10	19	16	.....	71
Illinois.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
Iowa.....	.....	.....	.....	1	2	.....	.....	.....	.....	3
Kansas.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
Maine.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
Massachusetts.....	11	8	6	5	8	8	3	3	.....	52
New York.....	3	2	.....	.....	1	5	8	1	.....	20
Pennsylvania.....	2	.....	2	2	3	1	2	1	.....	13
Rhode Island.....	1	.....	.....	.....	.....	.....	1	1	.....	3
Virginia.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
Totals.....	26	13	11	15	26	26	34	22	.....	173

General summary—cows.

Breeds.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Totals.
Aberdeen-Angus.....	15	34	63	170	152	142	165	203	117	.....	1,060
Ayrshires.....	1,324	476	481	481	460	463	422	486	369	228	5,190
Devons.....	791	286	319	308	345	407	452	467	523	393	4,201
Galloways.....	18	5	11	119	304	144	87	229	74	.....	991
Guernseys.....	265	130	179	234	331	338	345	344	311	51	2,528
Herefords.....	317	182	162	373	431	641	642	374	2	.....	3,124
Holstein-Friesians.....	194	256	375	441	787	1,782	3,419	2,694	2,897	2,906	15,692
Red Polled.....	.....	1	1	4	16	14	17	21	6	.....	80
Shorthorns.....	7,110	6,840	7,600	7,472	7,419	9,739	8,614	9,138	3,243	347	67,522
Swiss.....	26	14	18	41	35	35	37	26	.....	.....	232
Totals.....	9,999	8,224	9,209	9,643	10,280	13,706	14,200	13,982	7,542	3,925	100,710

General summary—bulls.

Breeds.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	Totals.
Aberdeen-Angus.....	3	3	19	40	58	103	166	160	45	.....	597
Ayrshires.....	577	240	243	196	171	210	239	204	152	71	2,284
Devons.....	339	200	191	176	209	251	285	339	364	348	2,702
Galloways.....	5	1	.....	33	52	111	184	261	93	.....	740
Guernseys.....	105	53	66	82	135	159	229	241	111	2	1,183
Herefords.....	187	80	77	212	279	458	656	444	2	.....	2,395
Holstein-Friesians.....	179	118	157	227	358	612	1,021	1,698	2,602	2,524	9,506
Red Polled.....	.....	.....	.....	3	7	5	9	13	10	.....	47
Shorthorns.....	3,107	2,607	2,535	2,272	1,695	3,223	4,026	6,315	3,602	289	29,671
Swiss.....	26	13	11	15	26	26	34	22	.....	.....	173
Totals.....	4,528	3,315	3,299	3,256	2,900	5,158	6,830	9,697	6,981	3,234	49,292

Dutch Belted cows.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	Total.
Illinois.....	.....	.....	.....	1	2	3	.....	1	3	3	.....	13
New Jersey.....	.....	.....	.....	.....	.....	1	1	.....	4	3	.....	9
New York.....	4	3	12	6	12	6	18	18	23	21	.....	123
Pennsylvania.....	.....	.....	2	1	1	2	4	.....	3	1	1	15
Totals.....	4	3	14	8	15	12	23	19	33	23	1	160

Of older cows eight were recorded in the herd-book of the association, in addition to which nine cows since dead were on record, making a total of 177.

Dutch Belted bulls.

States.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	Total.
Illinois.....	1	.....	1	.....	.....	.....	2
New Jersey.....	1	.....	1	.....	.....	.....	2
New York.....	2	7	6	.....	.....	22
Pennsylvania.....	1	.....	.....	1	1	3	.....	2	.....	8
South Carolina.....	1	.....	.....	.....	.....	1
Totals.....	1	.....	.....	3	4	12	6	9	.....	35

Of the 46 bulls recorded, 11 died.

Reports received from owners of purely-bred cattle in the United States indicate that the average selling value of such stock during the current year, at public and at private sales, was as shown by the following table. In the same table are shown the average cash values of one-year-old, two-year-old, and three-year-old "native" or unimproved cattle in the several States mentioned, during the same year. Females of all ages are included under the term "cows" in the table.

States.	Average prices.		Value of natives.			Value of grades.		
	Cows.	Bulls.	1 year.	2 years.	3 years.	1 to 2 years.	3 to 4 years.	Higher.
Alabama.....	\$97.78	\$67.83	\$10.00	\$15.00	\$20.00	\$22.50	\$59.00	\$65.00
California.....	249.35	93.89	14.57	29.71	33.12	43.75	61.25	76.66
Connecticut.....	171.00	185.00	15.90	23.56	31.00	37.50	66.00	79.17
Dakota.....	247.87	137.80	12.60	13.00	43.77	47.66	76.55	97.73
Georgia.....	97.78	76.83	7.00	12.33	15.00	15.65	45.55	63.33
Illinois.....	163.67	129.96	14.00	21.94	30.25	37.25	48.12	62.14
Indiana.....	261.21	124.11	13.72	21.43	29.88	32.21	44.23	61.42
Kansas.....	189.85	146.10	13.60	19.00	26.00	47.00	71.00	91.00
Kentucky.....	228.56	190.98	9.00	13.50	25.00	55.00	75.00	100.00
Massachusetts.....	137.88	119.37	11.50	20.81	27.50	32.51	35.00	75.00
Michigan.....	179.28	178.29	13.33	20.90	30.37	35.71	65.83	77.14
Minnesota.....	277.69	262.57	13.50	19.25	26.25	41.67	51.76	101.55
Montana.....	278.23	149.73	22.50	30.23	40.45	40.00	55.00	85.00
Nebraska.....	200.00	108.75	16.33	21.50	29.00	27.50	42.50	137.50
New Hampshire.....	234.66	134.07	13.88	21.32	28.86	30.00	35.00	50.00
New Jersey.....	261.88	312.12	13.00	19.33	27.66	18.00	60.00	70.00
New York.....	256.43	98.45	13.66	21.66	31.83	40.31	54.00	88.21
Mississippi.....	182.26	130.35	6.40	10.10	15.20	34.00	55.11	86.25
Ohio.....	193.03	96.96	13.50	21.17	31.24	36.80	51.00	68.55
Pennsylvania.....	266.88	151.35	16.70	25.50	35.30	50.00	56.00	89.44
South Carolina.....	143.42	95.61	8.23	14.66	19.33	27.33	40.00	50.00
Virginia.....	272.23	167.34	8.25	13.75	25.83	40.00	50.00	62.50
Wisconsin.....	288.08	208.38	9.44	17.11	25.66	45.83	58.33	73.57
Totals.....	212.15	146.34	12.61	19.58	28.59	36.92	54.62	78.75

Respectfully submitted.

E. W. PERRY.

CHICAGO, ILL., August 8, 1888.

EXHIBIT OF THE BUREAU OF ANIMAL INDUSTRY AT THE PARIS EXPOSITION OF 1889.

[Accompanying the exhibit of the Bureau of Animal Industry to the Paris Exposition of 1889 were the subjoined articles relating to the importance of the live-stock industry of this country. As these papers were prepared with great care, and contain much valuable information not readily accessible even to the special reader, they are inserted in this volume with a view to giving our own people a better understanding of the vast allied interests dependent upon our live-stock industry.]

MEAT INDUSTRIES OF THE UNITED STATES.

By H. C. CLARK, Esq.

Meat and dairy produce take third rank among the surplus productions which the United States exports for consumption abroad. Cotton and breadstuffs alone exceed them in value. This relative position is maintained, notwithstanding a decrease of 43 per cent. since 1881 in the exportation of hog products, due to prohibitory legislation by other nations. The exportation of these products, at its greatest development in 1881, amounted to \$104,660,000. During the past year (1888) it was \$59,229,000. The business of "pork packing," as it is termed, not only remains a leading factor in the foreign commerce of the United States, but it is third in importance among the domestic industrial pursuits of the country. The consumption of hog products in the United States is five times greater than the whole amount of such products exported. This fact gives home importance to the sanitary regulation of the business, and of itself insures the exercise of care in the production of an article of food which enters so largely into the daily life of 60,000,000 of people. The immense amount of capital invested, and the commercial necessity of protecting it from the risk of impairment, supply additional reasons for surrounding the trade with every wholesome precaution which science can devise or untiring energy suggest.

Next in importance to the avocation of pork packing among the meat industries of the United States is the trade in dressed beef. The average value of the exportation of dressed beef during the last ten years has been over \$17,000,000 per annum exclusive of the export trade in live-beef cattle. During the past year (1888) the exportation of dressed beef amounted to \$18,440,000, and of live cattle to \$11,577,000.

RAISING AND FEEDING CATTLE AND HOGS.

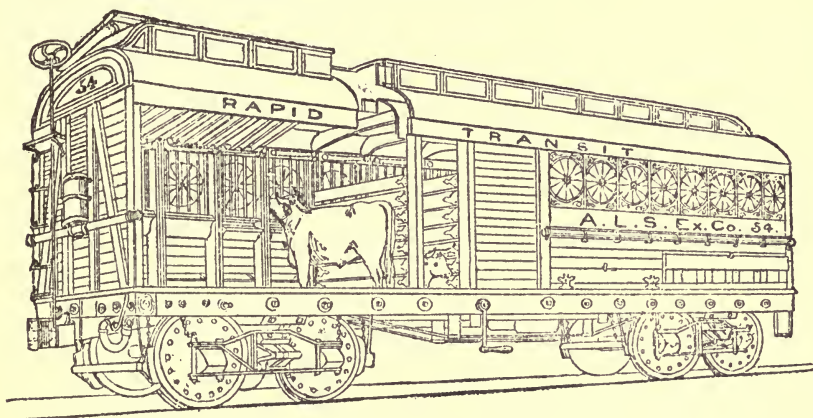
The chief supply of beef-cattle brought to shipment is derived from the State of Colorado, and from the Territories of Utah, Montana, Idaho, Wyoming, and New Mexico. Other cattle, not exclu-

sively grass-fed, come from the corn-growing belt, comprising the States of Illinois, Indiana, Kentucky, Iowa, Kansas, Michigan, Nebraska, Minnesota, and the Territory of Dakota. Cattle raising in the United States is a progressive industry, engaging a large amount of capital and skill. Nearly all the choice breeds known are represented among the herds brought to market. The so-called "native" cattle—descendants of the stock which the early Spanish explorers turned loose in the fifteenth century—have been re-enforced by the introduction of finely-bred Shorthorn, Hereford, Polled-Angus, and other improved cattle from the stock farms of Europe. Animals of the purest breed, which have transmitted their pedigrees unimpaired, are to be found in nearly all the States.

Most of the hogs handled in the packing-houses of the West are grown in Illinois, Iowa, Kansas, Missouri, Wisconsin, Nebraska, Ohio, and Indiana. These are known as the "corn-surplus" States, where so much Indian corn is grown that it is cheaper to send it to market in the form of hog flesh than to attempt its direct transportation in the kernel. The hogs raised in these States are almost exclusively of high-grade Berkshire and Poland-China breeds, unsurpassed for purity of strain, and all the qualities most esteemed for meat-raising purposes. The method of feeding them is clean and simple. As soon as they are able to shift for themselves the young pigs are turned out to pasture, being also fed with corn at certain hours of the day, or permitted to follow corn-fed cattle and to share their supplies. At the age of about six months the pigs are brought in and penned, and the work of fattening them for market commences. They are then no longer called "pigs"—a name technically applied only to young animals, less than six months old—but become the "hogs" of commerce. They are supplied in their pens with all the corn they can eat, and are given access to an abundance of clear, fresh water—this last being found by experience to be an essential requisite to the raising of the best quality of pork. The practice of feeding offal to swine is unknown in the pork-packing centers. It is chiefly confined to small butchers in country towns. The hogs thus fed are unsuitable for packing. They are slaughtered by their owners and sold in the local markets, and, when eaten imperfectly cooked or cured, are probably responsible for the few authenticated cases of trichinosis occasionally recorded in the public press of the United States. In Kentucky and other States where distilled spirits are manufactured on a large scale, hogs are sometimes fed on the grain "slops." The flesh of animals so nourished is soft, not adapted for curing, and can not be shipped to foreign markets. The hogs that are sent to the great pork packing centers have been fed almost exclusively on grass, and mast, and Indian corn. When they have reached a weight ranging from 150 to 450 pounds per head they are ready for market. The farmer hauls them in wagons or sleighs, according to the season, to the nearest railway station and consigns them to some commission merchant in Chicago, Cincinnati, St. Louis, or other pork-packing city. The hogs are carried by the railroads in well-ventilated, covered cars, and are tended and fed and watered by the way with more or less care. Precautions are taken to protect them from bruises or other injuries. The mark of a whip-lash or of a prodding pole is sufficient to secure the rejection of the animal by the packer. For this reason they are hauled to the railroad instead of being driven.

METHODS OF TRANSPORTATION.

Marked improvements have been made of late years in the methods of transporting live cattle and hogs to market. This applies especially to cattle. There is still room for further development in the manner of carrying hogs, so as to insure greater comfort and immunity from accidental death or injury. Formerly animals of all grades were carried in square open boxes, called cattle cars, into which they were crowded without much regard for bruises or broken limbs, and with little or no provision for feeding or watering them on the road. That system, happily, has been changed. Improved "palace" and "stable" cars have replaced the square box monstrosities in the carrying of all the best grades of cattle. The aim has been, not only to provide means for properly feeding and watering the animals en route, but to protect them as far as possible from injury and loss of weight in transit, and to reduce the time occupied by the journey to the briefest possible space. Ample compensation for the extra cost thus incurred is found in the excellent condition of the cattle when landed at their destination.



One of the best equipped of the palace-car companies engaged in carrying live-stock to market recently transported a herd of cattle from Idaho Territory to New York City, a distance of 2,500 miles, in one hundred and seven hours, and on disembarkation the cattle showed an average shrinkage of less than 20 pounds per head, or barely $2\frac{1}{2}$ per cent., as the result of the journey. The cars used by this company are constructed on the model of the Pullman passenger cars, with 42-inch steel-tired papier-maché wheels, elliptic springs, Westinghouse air-brakes, and automatic couplers so as to prevent any jarring at starting or stopping. The cattle are driven into these cars in the ordinary way, twenty to a car, and are then boxed off into separate compartments—one to each if desired—by transverse slats lowered from the roof. Each stall affords room for the animal to lie down at will. Food is dropped from a bin in the roof into mangers let into the sides of the cars, and water is supplied in troughs, similarly placed, from pipes running round the outside of the car and connecting with a tank in the rear. Fan wheels at each end, and a double roof, keep the cars well ventilated in the warmest weather. This line has over five hundred palace cars in successful operation. The method of construction is shown in the above sketch.

The "stable" cars are also furnished with hay racks and water-troughs--the former filled at the point of embarkation and the latter replenished at regular watering stations on the route. Each stable car will hold from 18 to 20 steers of the best grade. One company has fourteen hundred stable cars running on western roads, bringing live-stock to market in Chicago.

STOCK-YARDS AND PACKING-HOUSES OF CHICAGO.

The center of the meat-packing industry of the United States is Chicago. It is by far the largest shipping point for dressed beef and canned meats, and it also maintains a decided lead in the handling of hog products. The course of business in Cincinnati and St. Louis is similar to that in Chicago. Extensive packing-houses at Omaha (Nebraska), Kansas City (Missouri), and other points, are largely controlled by Chicago capital, and the method of business there pursued is substantially the same. The operations of the stock-yard and packing-houses of Chicago have therefore been selected for description as illustrative of the meat industries of the United States.

The plant of the Union Stock Yard and Transit Company, of Chicago, covers 350 acres in the town of Lake, 4 miles from Chicago city. The establishments of the meat-packers, adjoining and connected with the stock-yard, but forming a separate jurisdiction, known as "Packing Town," cover a like area, so that, in all, 700 acres of railroad tracks, pens, and buildings are devoted to the purposes of transporting, handling, and slaughtering animals, and packing meats.

The stock-yard has a capacity to accommodate at one time 25,000 cattle and 100,000 hogs. Practically the largest receipts in any one day have been 20,000 cattle and 66,000 hogs. The total receipts in the year 1888 were 2,611,543 cattle and 4,921,712 hogs. In addition to these, and outside the scope of this article, the yard has a capacity for receiving and handling a large number of sheep, and actually received over 1,500,000 in 1888. Twenty different lines of railroad concentrate in the yard, connecting with all points north, south, east, and west. The Stock Yard Company owns and maintains a double track, embracing 150 miles of main track, running all round the city, and connecting with every line that enters Chicago. It has its own water service and fire department; it provides a three-hundred room hotel, and a bank with a capital of \$750,000; and during the year 1888, with low prices prevailing, its business aggregated \$250,000,000.

At night the yard is lighted by electricity and securely policed. Cattle begin to arrive each day (Sundays excepted) between 7 and 8 o'clock. From that hour until 4 or 5 in the afternoon there is one continuous rush of business. Drovers, mounted on bronchos or hardy Montana horses or piebald Texas ponies, ride rapidly in every direction, cutting out stray cattle here, heading off a herd which is moving in a wrong direction there, and almost drowning with their shouts the bellowing of the cattle. Their high-backed saddles, with the ready lariat slung to the pommel, their quaint leather stirrups and high boots, into which the pantaloons are always tucked, give them a sufficiently picturesque appearance, even though the traditional cowboy's slouch hat has been discarded for cloth or fur caps, which, pulled down closely over the ears, are better adapted for Chicago winter weather. Buyers sorting and re-sorting cattle and

hogs in the pens, and commission merchants and their clerks hurrying between their offices in the Exchange building and the stock-pens, add to the animation of the scene; while the whistles and clanging of bells from innumerable passing trains, the lowing of cattle, the squealing of hogs, the bleating of sheep, the barking of shepherd dogs, and the yells of the drovers, all blended together, form a Babel of sounds only paralleled by the infinite variety of scents.

There are six landing platforms, but only two gates through which all cattle landed by the railroad companies must pass to reach the stock-pens. At each of these gates a State health inspector is stationed. These health officers are practical butchers, whose experience enables them readily to detect any cattle or hogs that may be suffering from disease, or are not in fit condition for human food. Every animal is subject to their inspection before it enters the stock-yard.

The largest consignments of corn-fed cattle are received in the early spring months. For the remainder of the year the supply is mainly drawn from the vast cattle ranches of Texas and the far western States and Territories. The stock are consigned to commission houses, of whom there are about two hundred doing business at the stock-yard. Each railroad company has an office on the platform at which the stock conveyed by it are unloaded. When a train of cattle or hogs arrives by that railroad it is bulletined at the office—that is, a notice is posted showing the consignor, the consignee, and the number of cattle or swine as the case may be. After the cattle or hogs have passed the health officer they are taken possession of by the Stock Yard Company, which pays the freight, and puts the stock in different pens according to ownership. The commission merchant to whom the stock are consigned gives to the company his orders concerning the feeding and watering of them. Whatever quality or quantity of food is desired is supplied by the company, which also furnishes men to see that the animals are properly cared for. When the cattle or hogs have been conducted to their pens the buyers of the different packing-houses—trusted and experienced men, receiving salaries ranging from \$5,000 to \$7,000 a year—examine the stock and put a price upon it of so much per 100 pounds as it stands. They exercise the right of selection, and rigorously exclude any animals which appear to have been injured or which seem in imperfect health or condition, or of inferior quality to the grade for which their orders call. There is a weigher in attendance on each buyer, who follows the cattle when they go to the scales and subjects them to further scrutiny. This is done when the buyers and commission merchants have agreed upon terms. The animals are weighed in the scale-house by the Stock Yard Company, a car-load at a time, and a stock ticket is made out, which decides the weight between buyer and seller. After being weighed the stock is driven back to the pens. The commission merchants settle with the company for the freight and the feeding and storage of the cattle, which are then turned over to the purchasers. Hogs are driven to the packing-houses over long, elevated wooden chutes or driveways, substantially built and roofed over, which lead directly from the pens to the slaughter-houses; cattle and sheep are usually driven on the level. In driving and handling stock in the yard as little violence is used as practicable. The office of the Illinois Humane Society is a conspicuous object at the entrance of the grounds, and the agents of that society are prompt to repress and punish cruelty. By their instrumentality, aided by two of the

most prominent packing firms, the use of the prodding pole and other cruel methods of driving cattle have been entirely abandoned.

In spite of every precaution, some dead or maimed cattle are found in almost every train load. The mortality among hogs in transit is also unavoidably great. The latter animals when ready for shipment are, in homely phrase, "fat as butter." In the course of the journey some of them get down in the cars, and unable to get up again, are trampled to death or smothered by their companions. Dead cattle and hogs entering the stock-yard in this way never pass into consumption as food in any form. A company, known as the Union Rendering Company, which, in fact, is an offshoot of the Stock Yard Company, has the exclusive right of receiving all such dead animals, at a price so profitable to itself that it keeps stern guard over the arriving trains and suffers no dead animal to escape. By that company they are rendered down into grease, glue, and fertilizers. There is but one way in which animals intended for human food can get into the packing-houses, and that is alive and on their feet. From the time they enter at the slaughtering end until they emerge at the other end, dressed, cured, salted, or canned, there is a continuous chain of manipulation, carried on by organized gangs of workmen, each under the control of a foreman, which could not be broken in upon without disarranging the whole course of business and attracting general attention. It must be obvious, without further demonstration, that, with the enormous capital involved, and dependent for its continued profitable employment on the maintenance of public confidence, no packer, even if he could do so without detection, would endanger the safety of millions of dollars for the insignificant profit to be derived from handling a limited number of diseased or dead animals in his business.

SLAUGHTERING AND DRESSING CATTLE.

Cattle purchased for packing are driven into pens at the slaughter-house, and detained there for some hours until they are cool and free from all excitement. In hot weather water is frequently played upon them through hose. When they are cool and quiet they are allowed to wander, or are gently urged down a chute which opens into a number of little pens, each just large enough to hold one fat steer, without allowing room for him to turn round. These are the felling pens. They are opened or closed at either end by a trap door. Sometimes the cattle find their own way into the pens through the open doors, but in any case they need but little urging to induce them to enter. Once inside, they never come out again alive. Commanding each pen is a narrow stage, roughly put together with a few boards and a gang-plank leading from pen to pen, raised about a foot above the level of the animal's head. On this stage the executioner stands, sledge-hammer in hand. He watches his opportunity until he sees the doomed steer standing perfectly still, with its head in the right position, and then, carefully taking aim, he delivers one crushing blow in the middle of the forehead. Without groan or cry the animal drops, stunned and insensible, the sound of its fall reaching the ear almost at the same instant as the crash of the blow. The trap door in front of the pen is quickly raised; a chain attached to steam machinery is thrown over the animal's horns, and it is dragged out upon the slaughtering floor. There one or more blows are given it and its throat is cut, to complete the work begun in the felling pen,

but almost invariably the animal after it is first dropped evinces no further sign of life except a convulsive kick when the spinal marrow is severed. As soon as the throat is cut the skin of the head is flayed and thrown back on the hide; the head itself is cut off; a chain is passed round the hind legs, and the animal is hoisted from the ground and suspended to a steel bar or "run" over a wooden gutter running down the middle of the floor, and is allowed to hang there until all the blood has drained out of its body. This takes from ten to fifteen minutes. The whole process of felling, slaughtering, decapitating, and hanging up on the "run" to bleed has occupied not longer than a minute and a half. The thorough method adopted of bleeding the animal is an important feature in the system of slaughtering. All the arteries of the neck being severed, and the animal being hung up, neck downwards, whilst the circulation is still hot and active, there is no possibility of the blood coagulating in the carcass, as in the case of cattle allowed to lie on the floor until they are half skinned and partly dressed.

It is a marked peculiarity of the system adopted at the great packing-houses, in some of which 2,000 to 3,000 cattle are killed in a day, that the victims manifest none of the restiveness and painfully obvious alarm observable in cattle dragged into a country slaughter-house to be butchered. They seem to have no premonition of their fate until felled by the sledge-hammer, and after that there are no signs of consciousness. It is murder reduced to a fine art. There is so little unusual or alarming noise that even the steer in the next pen to the one that is being slaughtered shows no uneasiness and betrays no anticipation that it is its turn next. Other methods of killing—shooting with a rifle, or spearing the base of the brain—have been tried, but felling with a sledge-hammer, when skillfully done, is found by experience to be the most speedy and humane method, and it is now generally followed.

After the carcass of the slaughtered steer has been thoroughly drained it is carried along on the "run" to the skinning bed, where it is lowered on its back and split from the breast-bone backward, and the skin is loosened from the sides by a peculiar free sweep of the knife requiring long practice to accomplish. While in this position the caul fat is removed and applied to purposes hereafter described in connection with the manufacture of oleo oil. Then the animal is again hoisted to the "run" and the paunch, intestines, etc., are taken out and the hide removed, after which it is split down the back and becomes two sides of beef. These are carried on runners to another part of the slaughter-house, where the flesh is thoroughly washed on the inside, and wiped on the outside with a clean dry cloth. It is afterwards permitted to remain in the ante-room of the cooling-room until the animal heat has gradually passed away. The beef is then run into the cooling-room and chilled for from twenty to forty-eight hours according to weight. The largest packing-houses have four of these cooling-rooms, each with a capacity of 900 carcasses, but usually, in order to insure free circulation of air, not more than 600 beeves are hung in any one room at the same time. A uniform temperature of about 38° F. is maintained in the cooling-rooms, by means of artificially iced brine, pumped by powerful engines into pipes running round the sides of the room. Electric lamps penetrate to every corner of the building, and give weird effects of light and shade as the different gangs of white-frocked workmen move about among the ruddy carcasses.

Between the cooling-rooms and the platform where the refrigerator cars are drawn up ready to convey the dressed beef to its destination is the shipping-room. The meat, after being quartered, is here subjected to rigid inspection before shipment, so that none showing any blemish shall pass into the car. These refrigerator cars are nearly 30 feet long by 8 feet wide, with a space of over 7 feet between the floor and the cross-bars on which the meat is to be hung, and a further space of 14 inches between the cross-bars and the roof. Thus, the hooks being placed sufficiently wide apart for this purpose, air can freely pass all around the beef while in transit. Each car will hold about 30 carcasses of selected beef, averaging 650 pounds each. The hind quarters are hung at one end of the car and the fore quarters at the other. In the roof of the car there are four or more galvanized-iron tanks, each capable of holding two tons of ice. These are filled from the outside, through small hatchways, with a mixture of pounded ice and coarse salt, which is renewed at designated stations on the route as required. The tanks thus filled create a temperature of from 36° to 38° F. in the closed car. The air, as it comes in contact with the tanks, becomes chilled and descends, displacing the lighter and warmer air, which naturally rises and becomes in turn chilled, and thus a constant current of rarefied air is maintained in the car, which keeps the meat in perfect condition, without its ever having been frozen or coming in direct contact with ice.

An impression of the extent of the dressed-beef trade of Chicago can be gathered from a statement of the business done by the four leading firms. During the year 1888 Armour & Co. slaughtered, for dressed-beef and canning purposes, 561,000 cattle; Swift & Co., for dressed beef exclusively, used 484,000 cattle; Nelson Morris and the Fairbank Canning Company slaughtered 468,000 cattle; and the Hammond Dressed Beef Company, 220,000 cattle. There are other firms and companies engaged in the business of packing and canning beef, but not on so broad a basis. The total business of Armour & Co., last year, amounted to \$55,000,000.

The extensive scale upon which operations are carried on gives value even to those parts of the animal heretofore regarded as worthless, when accumulated in such bulk. Nothing is wasted. The feet and heads, the latter of which in past years were often buried on the prairies, are converted into glue and fertilizers. The hoofs, horns, bones, etc., are shipped East and made into knife-handles and various kinds of ornaments. The blood drained from the slaughtered animals is caught and cooked and dried and pressed, and becomes a valuable fertilizer. The skins of the intestines, properly cleaned, form sausage-casings. The offal and refuse go to the fertilizer factory, and even the floor washings, collected in the sewers, yield wagon grease. The hides, of course, are sold to the tanners, and form a very valuable item. There have been occasions when hides were worth 10 cents a pound, and beef only 5 cents a pound at wholesale. The glue and fertilizer factory in which Armour & Co. utilize their refuse products covers 11 acres, employs 500 men, and turned out, in 1888, 6,000,000 pounds of glue, 14,000,000 pounds of fertilizers, and 4,000,000 pounds of grease. It is this concentration of force and economy in handling which gives the large packers their advantage and enables them to compete so successfully in the markets of the world.

SLAUGHTERING AND PACKING HOGS.

When a drove of hogs have been purchased for a packing-house, and all the preliminary obligations of health inspection, weighing, etc., have been complied with, they are driven up an inclined plane to a covered elevated run-way leading to the pens of the particular packing-house which is to be their final destination. Here they are given time to rest and cool off, and become acquainted with their new surroundings before entering upon their further adventures. After sufficient interval has elapsed for this purpose—usually from twenty-four to forty-eight hours—during which time they are fed with corn and carefully watered, a man, known as the “shackler,” enters the pens, and, lifting a hind leg of each unsuspecting animal, slips over it a stout oval iron ring, which lodges just above the joint. Into this ring, at the proper time, he inserts the smaller end of a double hook attached to a chain. This is quickly drawn up by machinery, and lifts the astonished and protesting hog, head downwards, 8 or 10 feet from the ground. The larger end of the hook is thrown across an inclined steel rod or “run,” and a gentle push sends the hog sliding along this rod to a platform where stands the “sticker,” knife in hand. With marvelous celerity—frequently at the rate of eight or ten a minute—he plunges the sharp-pointed, keen-edged weapon into the animal’s gullet, and makes a longitudinal upward cut, 2 or 3 inches in length, from which the blood immediately gushes like water from a rain-spout. A touch from the sticker’s hand sends the dying hog sliding a few feet further. There it is allowed to hang, squealing with scarcely abated vigor, for about five minutes, until all the blood has drained from its body. Then, almost before the last gasp of life has left its quivering carcass, it is plunged off the end of the rod into a cauldron of boiling water, in which it is immersed just long enough to loosen the hair from its hide. It is lifted out of the scalding-vat by an ingenious automatic contrivance and landed on the draining-table, where one man, if it be winter time, plucks the bristles with which at that season of the year it is adorned, and another man, standing on the opposite side of the table, connects the carcass with an endless chain, which lands it against a set of revolving vertical wheels, with flexible broad steel flanges projecting from their outer rims. This machine, in a very few seconds, scrapes every vestige of hair from the accessible parts of the hide. As the hog emerges from this treatment it is thrown upon a long table, where, from first to last, sixteen men, eight on each side, await its coming. Two of them shave from under the arm-pits the few hairs which the scraping wheel has been unable to reach. The next man, at one stroke, severs the head nearly from the body, leaving it hanging only by a shred. His assistant meanwhile has cut two slots in the hind legs and thrust a “gambol stick” into the holes thus made. He slips one end of a double hook round this gambol stick and slides the other end over the run, and with a gentle shove starts the hog again upon its travels. Ten minutes have sufficed to transform a well-fed, contented hog into a headless, hairless carcass. All the time it is running the gauntlet a stream of cold water is continuously pouring down upon the animal, and washing away all traces of the cutting and slashing to which it is subjected. The next man opens the animal and takes out the paunch and intestines, etc., while another removes the leaf fat, subsequently to be used in making “neutral” for oleomargarine, as hereafter explained. A little

further along, another operator "faces" the hams—that is, with a sharp-pointed knife he traces on the hide the shape of the hams which are eventually to be cut. By this time the hog has journeyed about twenty-five feet from the scalding-vat into which it was first plunged. At this point the head is completely detached. The tongue is taken out, to be canned for lunch purposes, and the head is either singed and made into English brawn, or the cheek meat is cut off and the rest rendered into lard, according to the price which either commodity commands in the market at the time. The carcass is pushed along a little further, and a skilled hand marks a line down the back to guide the chopper. The gambol stick is removed; a boy pulls a rope tied to one of the hind legs, so as to stretch the legs apart, and the chopper, with a meat-ax, divides the headless carcass into halves down the middle of the spine. It is then carried on runners to the hanging-room, where it is allowed to remain till the last vestige of animal heat has departed, prior to its being taken to the chill-room. This is a most necessary and carefully observed precaution, for if the carcass were immediately conveyed to the chill-room the cold air would congeal the outer flesh, leaving the animal heat within, and the meat would sour in the curing.

The chill-room is maintained at a temperature of about 36° F. the year round. In warm weather this temperature is obtained, in the best-regulated packing-houses, in the same manner as in beef-packing, by salt water, refrigerated by the evaporation of ammonia, pumped into pipes encircling the room. In other houses less uniform results are obtained by the use of ice. After remaining in the chill-room about forty-eight hours the meat is hauled out by an endless chain and dropped upon the chopping-block. There, at two strokes, each segment of the defunct hog is cut into three. The ham is cut off at one stroke, the shoulder at another, and the side is thus left. These are trimmed to the desired shapes and are ready for curing.

Every part of the animal is utilized. The lean-meat trimmings from the hams, shoulders, and sides are made into sausages; the feet are pickled or canned; the ears and other gelatinous parts are converted into glue; the blood, dried and pressed, brings 1½ cents a pound as a fertilizer; the skins of the intestines are cleaned for sausage-casings; the bristles and hair are sold; and the intestines, trimmings and other refuse are tanked for soap-grease, and the residuum makes fertilizers.

The methods of curing are as follows:

The first destination of the meats about to be cured is the cellar, a dry, flagged chamber, kept at a temperature of about 40° F., and from which all daylight is excluded. Here the hams are assorted according to weight, and sprinkled with saltpeter, salt, and granulated sugar. At the end of ten days they are turned and resprinkled, and left to cure for twenty or thirty days longer. The sides are treated in a similar manner, unless intended for what is technically termed "mess pork," in which case they are cut into uniform pieces, packed in barrels in dry salt, and pickle afterwards poured over them.

When the hams, etc., are received in the cellar from the cutting-room they are scraped and cleaned, and any defects of trimming are rectified, and at the same time they are carefully inspected for any signs of taint or bruise or other imperfection. Those that are found perfect are taken back to the chill-room and put on racks and chilled

for at least twenty-four hours. After that they are brought out and packed in tierces in a pickle composed of sirup, sugar, saltpeter, salt, and other ingredients, and are allowed to remain in this pickle in the chill-room from sixty to seventy-five days before they are deemed sufficiently cured to be smoked. They are then taken out of the pickle, washed, and taken to the smoke-house. Usually this is a 12-inch brick building, three stories high. It is divided into floors by movable racks, which are withdrawn after the hams have been hung upon hooks on rafters provided for that purpose. A fire of hickory or maple wood—the latter is regarded as giving the better flavor—is kindled below, the smoke-house is closed, and the hams, etc., are smoked for forty-eight hours. They are then ready for market. No cured meats are sent out that have not undergone at least thirty-five days' pickling—a period of time sufficient to destroy all germ life. The great bulk of the cured meats remain in pickle, or otherwise under vigorous treatment, for a much greater length of time.

Periodical inspections of hams, etc., are made by officers of the Chicago Board of Trade, and it is always optional with purchasers to cause such inspection to be made before delivery. The principal packing-houses have repeatedly offered to co-operate in establishing a uniform system of inspection of their meats by the General Government, prior to shipment, and a measure is pending in Congress with that end in view. They conduct their business with the utmost publicity, and permit visitors to enter any part of their establishments to witness the operations in progress.

CANNED MEATS AND SOUPS.

The canned-meat industry of Chicago has developed into gigantic proportions. The cannery of Armour & Co. has a capacity of putting up in one day 225,000 pounds of corned beef, 50,000 pounds of fresh boiled beef, 10,000 lunch tongues, 4,000 ox tongues, and a multitude of minor products. This firm has been awarded for the past three years in succession the contract of supplying the French Government with canned "*bœuf bouilli*" for army and navy use. Other establishments have almost equal canning facilities.

Cattle killed for canning are usually well fattened native cows, and Texas and other range cattle, such as are usually ranked in the market as good butchering cattle. Corned beef, after being first salted and cured in the chill-room, at a temperature of 38° F., is taken over to the cannery and cooked by steam in hot water. It is then put upon the chopping-table and cut up. Hand labor is employed for this purpose, because it is necessary to select the parts of the beef that go into the cans, and to throw out the gristle and other unsuitable portions. The best cuts of table beef are selected for canning purposes. This process over, all the rest of the manipulation is done by machinery. The cans are placed in a receiver and are charged from the bottom. A steel plug or plunger presses the beef compactly into the cans. They are then weighed, and any shortage or overplus is rectified. A circular orifice is left in the bottom of the can. Upon this a disk of tin plate, with a small hole in the center, is laid, overlapping the orifice, and firmly soldered round the rim, leaving the little aperture in the middle still open. The cans are next placed in a steam bath for about 30 minutes, which creates a vacuum. As soon as the air is thus expelled from them, the remaining opening is quickly soldered, and the can is then air-tight,

or should be so. Each can is tested by an expert, who ascertains by sounding if there is any defect. If so it is thrown out, but if found perfect the cans are run through steam and washed in hot water to remove all particles of grease from the outside, and are then plunged into a bath of cold water to collapse them. The only remaining process is the lacquering and labeling. This is done by girls and women.

Chip beef is pickled for thirty days, in the same way as corned beef. It is afterwards smoked for forty-eight hours, like hams, and hung in the drying-room for ten days or two weeks, where it dries in the natural air. It is then sliced by machinery and placed in boxes for market.

Extract of beef is prepared in vacuum pans, by a process which extracts from the material only its nutritive properties. Twenty-one pounds of beef, treated by this process, yield one pound of thick extract. Twelve pounds of beef yield one pound of liquid extract. One ounce of thick extract will bear the addition of forty ounces of water, and will then form a rich soup. One ounce of liquid extract will bear ten ounces of water. Prime cuts of beef are used for this purpose, of necessity, because the process requires that the material employed shall contain as little gelatinous matter as possible. As prepared in the Chicago canneries the extract of beef is a light chocolate color. It has neither the dark hue, the burnt taste, nor the peculiar odor which pertains to extracts prepared in South and Central America.

Ox and other tongues are cured in the chill-room, are carefully examined for blemishes, and such as are found perfect are skinned and placed in cans, one ox tongue to a can, and sorted according to sizes. The cans are soldered, lacquered, and labeled as with corn beef.

In the preparation of soups, etc., skilled *chefs* are employed, and the soups are made and cooked as they would be in a first-class hotel or restaurant, except that they are not cooked to a finish, a margin being left for the steaming process they have to undergo in canning and for the warming over to which they will be subjected before being brought to the table. For chicken soup chickens are purchased, ready dressed, in the country, many thousand pounds at a time. They are partly cooked; the breasts, legs, and wings are cut up and packed in cans, in the proportion of eight ounces of solid meat to a 2-pound can. The rest of the chicken is boiled down into "stock" and added to the meat until the can is filled. It is then placed in a steam bath and soldered as other goods.

All the principal canning establishments make their own cans. They use the best steel-plate tin, the best solder, and invariably solder from the outside, thus avoiding all danger of so-called "can poisoning" which occasionally arises from the practice of soldering from the inside of the can.

OLEO OIL.

The product known to commerce as oleo oil is obtained from the fat of beef-cattle. Immediately after the animal is slaughtered the caul or abdominal fat is removed, carefully washed, and passed through a series of vats of cold water until the animal heat is entirely eliminated. The fat is then chopped by machinery and dumped into vats of broken ice, where it is chilled. It is fed from these vats,

by an endless chain, into a machine called the "hasher," which, revolving at a high rate of speed, completely macerates it, so as to allow of the separation of the fiber from the fat at a temperature considerably below boiling point. From the hasher it passes through sieves directly into the refining tanks. These are kettles from 3,000 to 5,000 pounds capacity, fitted with steam jackets and revolving blades or stirrers. Steam is turned on until a temperature of about 150° F. is reached. The fat dissolves in this heat, and when the revolving blades are stopped the scraps fall to the bottom and the molten fat is drawn off by a siphon into the graining or seeding vats below, where it is allowed to gradually solidify. In about forty-eight hours it forms a partially solid granulated substance, of a pale yellow color, without distinguishing taste or odor. It is then ladled into stout linen cloths and spread upon metal plates in a powerful screw-press and subjected to a pressure of about 150 pounds to the square inch. The oil thus expressed is oleo oil. The fibrous matter left in the cloth in the press is white in color, brittle to the touch, and slightly waxy to the taste. It is called oleo stearine and is used in the manufacture of compound lard.

There are three grades of oleo oil—No. 1, No. 2, and No. 3. The difference consists in delicacy of flavor and fineness of granulation. No. 1 is made exclusively of selected caul fat. Nos. 2 and 3 are made by a similar process, but with an admixture of kidney and other fats, which give a coarser grain to the oil and impart a slight flavor, which is entirely absent from oleo No. 1.

Nearly 40,000,000 pounds of oleo oil were shipped from Chicago to Holland during the year 1888.

OLEOMARGARINE.

Strictly speaking, oleomargarine, as formerly known to the trade, has ceased to be an article of general manufacture in the United States. It was composed of oleo oil, churned with milk and cream, and sometimes with a small quantity of creamery butter, the whole being salted and colored in the same manner as butter. The product which is now chiefly manufactured and sold under that designation is known to the trade as butterine. It is composed of similar materials to those of oleomargarine, but in different proportions and with the addition of "neutral," a substance derived from the leaf fat of hogs.

The laws of the United States require all food products made in the semblance of butter, and not made exclusively of milk or cream, to be branded and labeled "oleomargarine." Hence that term is applied to all such products. A tax of 2 cents per pound is imposed upon the article, and those who manufacture it are required to take out licenses and to conduct their business under the supervision of officers of the Government. Dealers in the article are also required to pay licenses and to submit their books to the inspection of the proper officers of the United States. The total amount withdrawn from factories, tax paid, during the fiscal year 1888, was 32,489,165 pounds, of which 1,686,198 pounds were exported, leaving a balance of 30,000,000 pounds for home consumption.

The leading ingredients in the so-called oleomargarine, as already stated, are oleo oil and neutral. The manufacture of neutral lard is conducted by essentially the same machinery and at about the same temperature as the manufacture of oleo oil. Only the leaf fat of

freshly killed hogs is used, and, as also in the case of the beef fat, scrupulous care is taken that every piece used shall be without taint of any kind. The neutral is not pressed to extract the stearin. As it falls from the melting kettles into tanks of strong iced brine placed to receive it, it crystallizes into flakes, white as snow, and absolutely without perceptible smell or taste. It remains in these vats about twenty-four hours, and is then removed and placed on shelves to drain, after which it is ready for use. The object of the process is to obtain a neutral fat melting at butter temperature.

Most oleomargarine factories are buildings four stories in height. On the upper floor the oleo oil and neutral are melted in separate kettles, at a temperature of about 90° F. The proportion of milk and cream which enters into the product is from 10 to 20 per cent. One of the firms largely engaged in this manufacture in Chicago (Friedland & Swift) have in their establishment a well-appointed dairy, heated by steam pipes to the required temperature, in which pans of cream and milk are set out to sour, and are afterwards separately churned into butter precisely as in a creamery dairy. The more usual process is for the charge of cream and milk, slightly soured, to be first run into a steam-jacketed churn, fitted with steam paddles, which are agitated until butter begins to form. Then the oleo oil is let down and stirred in by the agitators. After it has been thoroughly mixed the neutral lard is added, and lastly a small quantity of best quality of creamery butter, and sufficient annatto (the harmless vegetable coloring used in butter-making) to give the required tint. The temperature during the churning process is carefully regulated, beginning at 85° F. and running up to 105° F., and the time occupied varies from twenty-five minutes to an hour and a half. Some manufacturers, in order to soften the granular consistency of the oleo oil, and to give a better texture to the whole product in cold weather, add a certain proportion of refined cotton-seed salad oil. In the higher grades of oleomargarine this result is attained by decreasing the proportion of oleo oil, and adding more creamery butter.

When all the contents of the churn have been thoroughly amalgamated they are discharged into vats of chopped ice in the floor below. The object of this sudden process of cooling is to give a fine grain to the product. The oleomargarine is allowed to remain in these cooling-vats from thirty to forty-eight hours, until completely solidified. It is then taken out and placed on wooden trays to drain, and afterwards is salted and thoroughly worked by mechanical rollers, in the same manner as butter, until all the buttermilk and water have been pressed out. It is then cut and weighed and molded into the required shapes, which vary according to the market for which it is intended. After that it is placed on racks in the cooling-room, at a temperature of about 38° F., and there it stays until packed in stamped tubs and boxes, of sizes regulated by the Government, when it is ready for shipment.

Scrupulous cleanliness is observed in every process of the manufacture. This is more than a matter of choice; it is a necessity. Any deviation from it would be perceptible in the manufactured article. The kettles, tubs, tanks, molding-boards, and even the floors of the factories are constantly scalded, steamed, and scoured, and kept as clean as the dairy rooms of a model farm.

Oleomargarine, under ordinary conditions, will keep sweet and free from rancidity for three months, at least; it has been kept unimpaired much longer. The completed product, as it leaves the factory,

looks and smells and tastes like good creamery butter. Some of the members of the wealthy firms engaged in its manufacture boast that they serve no other product at their private tables.

LARD.

There are three grades of lard.

1. *Prime steam lard*.—This is the leaf fat of hogs, and the selected fat trimmings, cooked in a closed tank, by wet steam, at a pressure of from 35 to 40 pounds, for from twelve to sixteen hours, after which the tank is allowed to settle and the lard is drawn off.

2. *Pure kettle-rendered lard*.—This consists of the fat backs and other trimmings of hogs, rendered in an open kettle, and agitated while cooking to prevent burning.

3. *Refined lard*.—This is a compound production. It includes, besides a certain proportion of the higher grades of hog fats, the lard stearin left in the extracting of lard oil from leaf lard, the settlings and scrapings from the kettles from which the neutral lard is made, and all available fat tissues of the hog, to which are added the beef stearin obtained in the manufacture of oleo oil and a certain quantity of double-refined cotton-seed salad oil. The preparation of this product involves the employment of a somewhat complicated arrangement of steam jackets, hot-air agitators, settling-kettles, filters, and other machinery.

The completed product of the third grade is sold for what it is—a compound lard; but the first two grades are inspected by the Board of Trade, and branded with a certificate of their purity before being put upon the market.

TRICHINIASIS AND HOG CHOLERA.

It only remains to speak of the questions whether the parasites found in trichinous hogs can be transmitted in a living state in the pork exported to European countries by the United States, and whether the flesh of animals dying of hog cholera or swine plague is ever converted into a food product.

On these points official investigations of an exhaustive character have been had. As a preliminary step the Department of State, in March, 1881, prosecuted an examination into the various phases of the pork industry in the Western States, covering all possible causes which could operate to render the products dangerous to health. The President of the United States, October 3, 1883, appointed a commission of impartial scientists and representatives of the New York Chamber of Commerce and the Chicago Board of Trade, instructing them "to make a searching examination on the spot of all the conditions of the hog-raising and pork-packing industries of the United States, and to follow by the most practical examination the course of this food staple from the fields and farms to the wharf where it is shipped, or to the shop where it is exposed for domestic consumption." The results of these investigations were communicated to Congress by the Executive, accompanied by voluminous diplomatic correspondence, and other information bearing on the subject.* From the official data thus presented, which remain uncon-

* Ex. Doc. No. 209, 47th Congress, first session. Senate Report No. 345, 48th Congress, first session, embracing Ex. Doc. No. 70, 48th Congress, first session.

troverted to this day, these broad deductions and statements of facts are derived :

It is conceded that the *Trichina spiralis* is found in American swine, though the proportion of animals thus infested appears to be less than in the countries of Europe. No definite conclusion as to the manner in which swine become affected with the disease has been reached. It is established that hogs may present every outward appearance of health and yet microscopical examination may develop the presence of trichinæ.

In the human subject the disease is developed from eating freshly-killed pork, either raw or only partially cooked. The virulence of the disease diminishes with the time elapsing between the killing of the animal and the consumption of the flesh.

No case of trichiniasis has ever occurred in any European country as the result of eating cooked American pork, whether cured or fresh.

No authentic case of trichiniasis has been clearly established in any European country resulting from the eating of cured American swine products, as prepared in the export packing-houses, whether the meat has been eaten raw or cooked.

The prominent cases of trichiniasis occurring in foreign countries, and ascribed to American pork, have in every instance on investigation been ascertained to be the result of eating home-killed swine, or the product of other countries than the United States.

The trichina can not long survive in well-salted meat. If transmitted in its encysted state abroad in American pork the cyst of the parasite is its tomb. The testimony of Professor Virchow is that American trichinæ lose their injurious properties through smoking, salting, pickling, and especially through the long journey, and that he has not been able to find one case of trichiniasis caused by American bacon or ham.*

No case of trichiniasis has ever arisen from eating American canned meats, because such meats are always subjected to a temperature above boiling point, in some instances as high as 240° F.

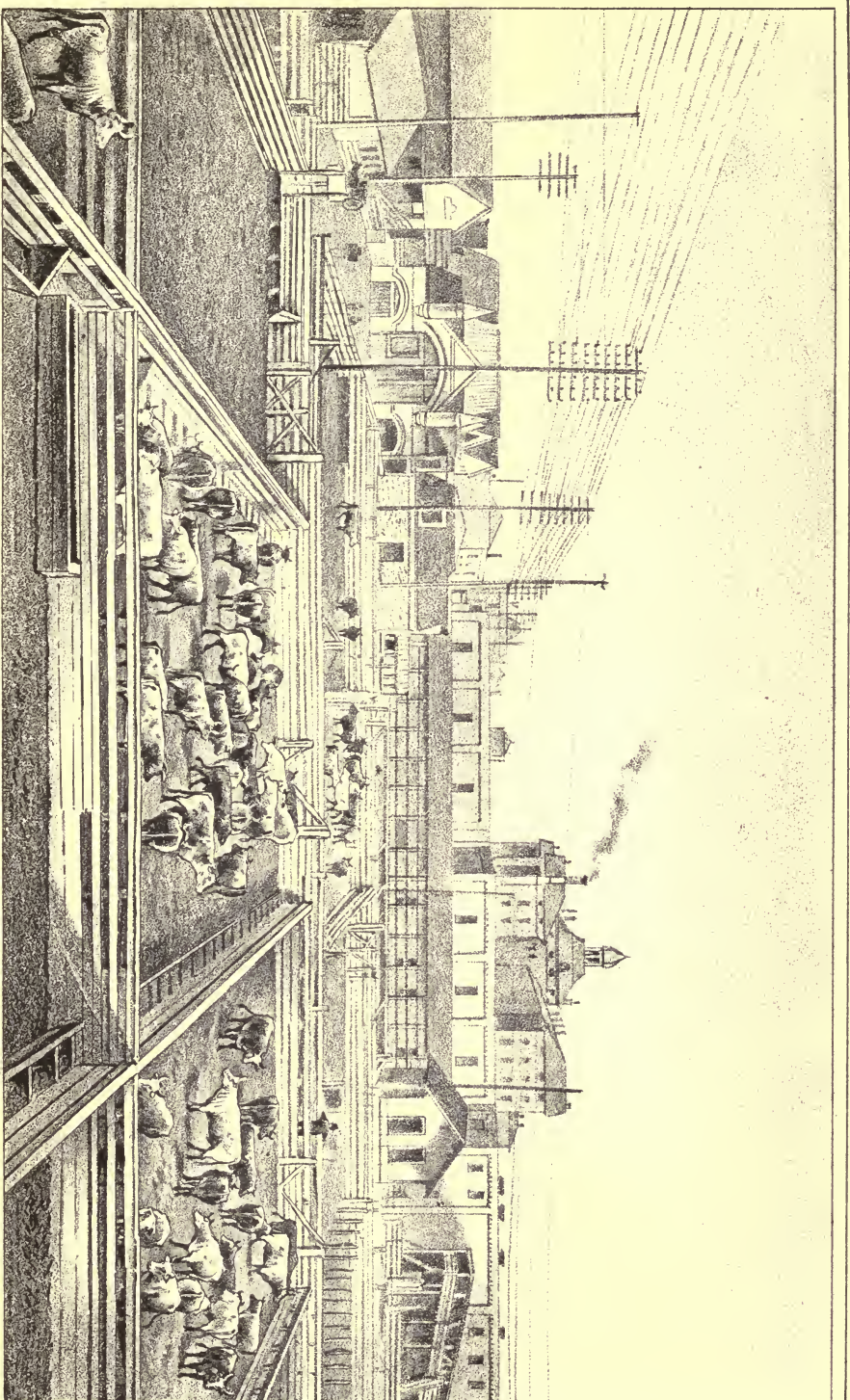
No death from trichiniasis has ever occurred in the United States Army or Navy, though packed pork forms part of the daily food in both branches of the service. No case of trichiniasis has ever been brought under treatment in the United States Marine Hospital Service.

Though the annual consumption of hog products in the United States amounts to over 4,200,000,000 pounds, no city or State, in the exercise of its police powers, has found it necessary to attempt to restrain the use of American pork meats on sanitary grounds, or for any other reason. Fatal cases of trichiniasis are extremely rare in the United States, and almost invariably occur among foreign-born residents, and from eating uncooked the flesh of improperly fed swine, such as would be immediately rejected if offered for sale to the packing-houses which kill and cure hogs for the foreign market.

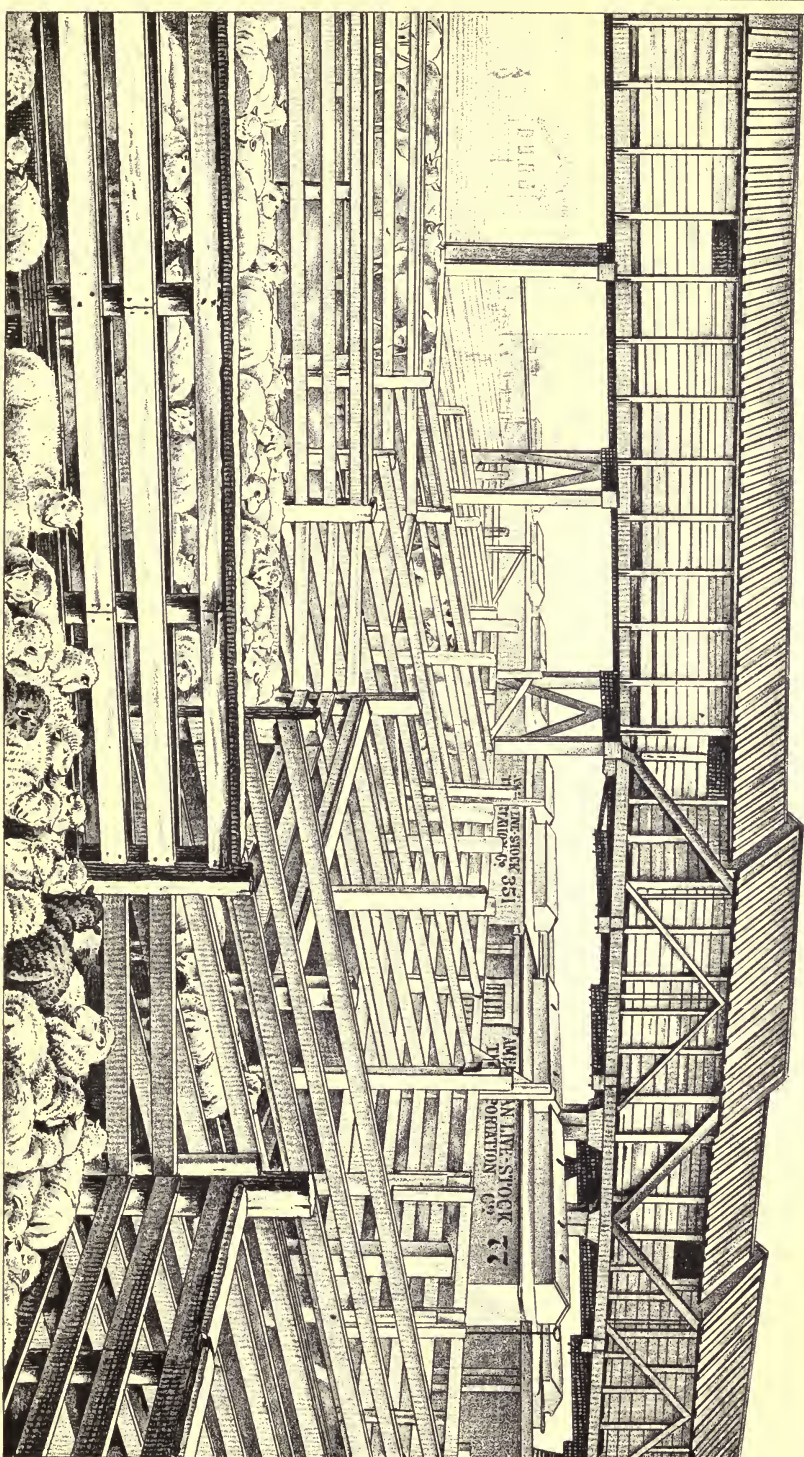
In respect to the disease known as hog cholera, or swine plague, the facts disclosed by the official reports above referred to conclusively establish—

That the disease attacks most frequently young pigs before they arrive at marketable age.

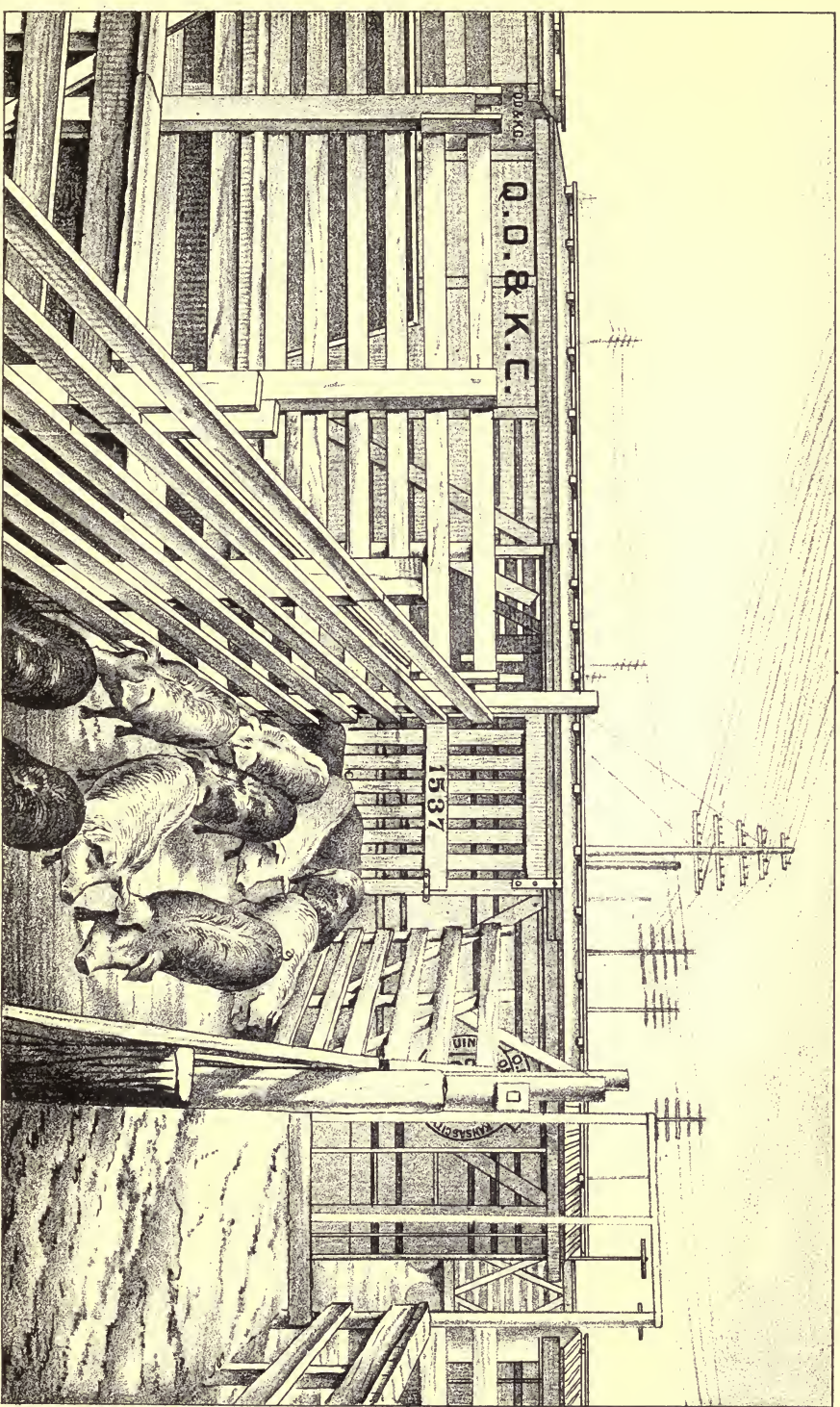
* Professor Virchow, as quoted in the Magdeburger Zeitung, January 12, 1883. Senate Report No. 345, 48th Congress, first session, p. 117.



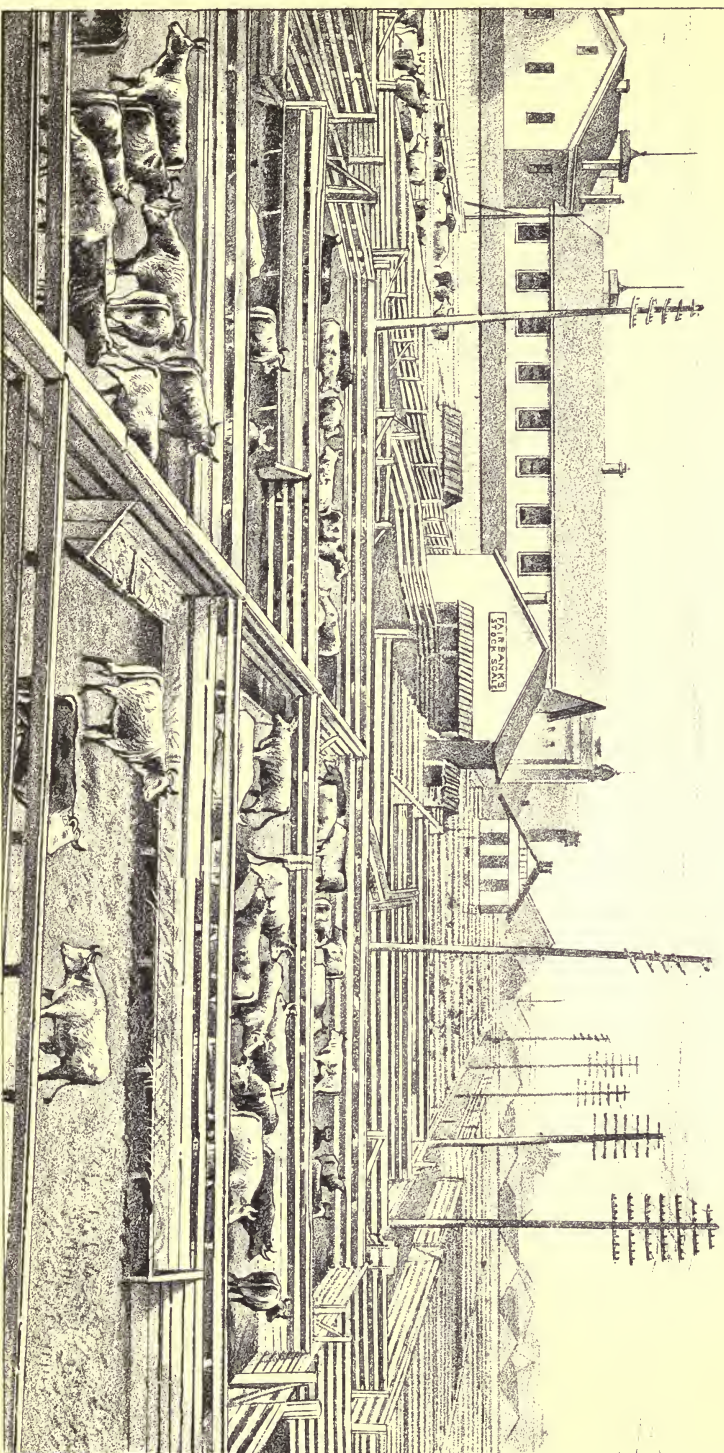
CHICAGO STOCK YARDS. GENERAL VIEW LOOKING WEST TOWARD GATE.

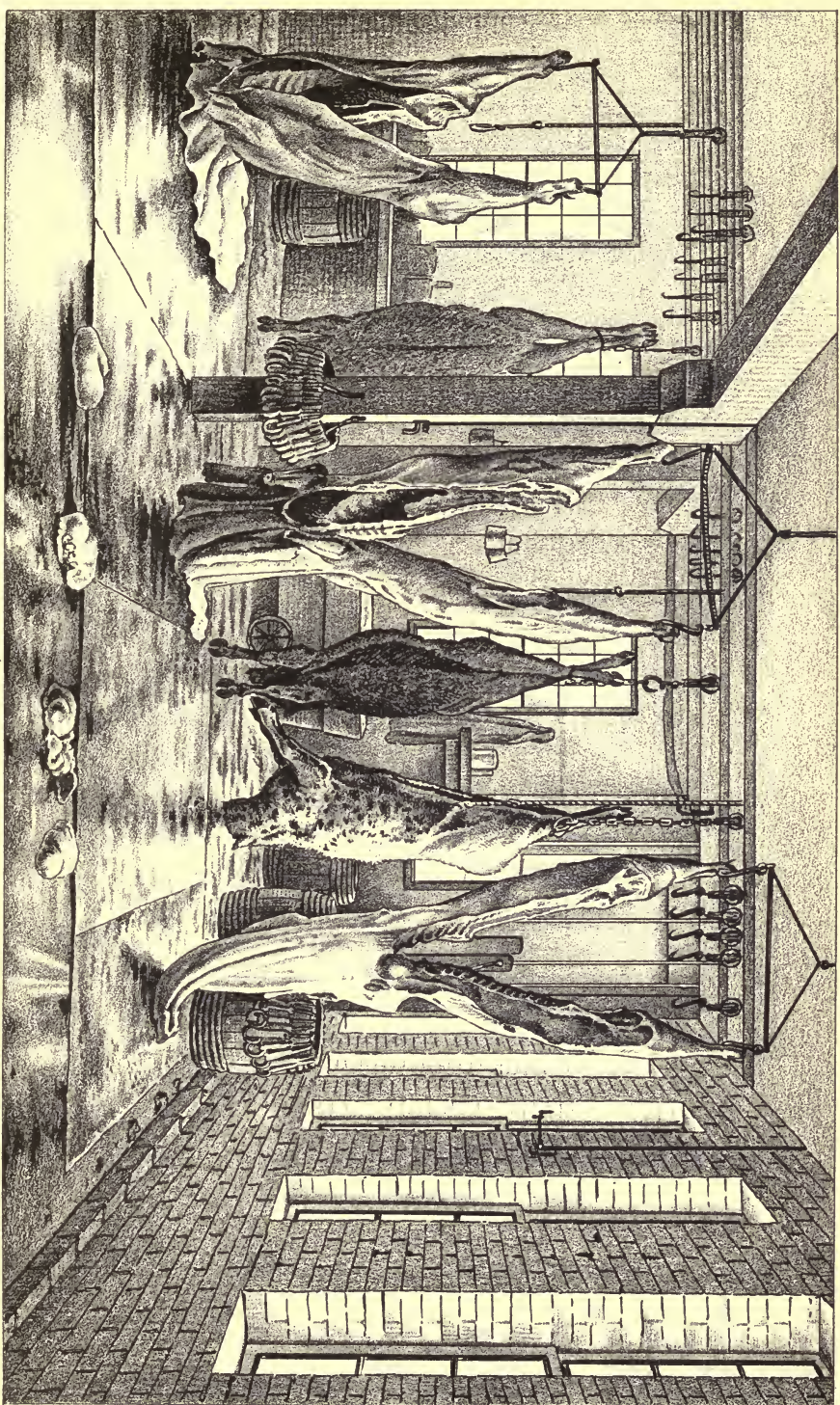


GENERAL VIEW OF CHICAGO STOCK YARDS. COVERED LOG RUNWAY AND PENS.

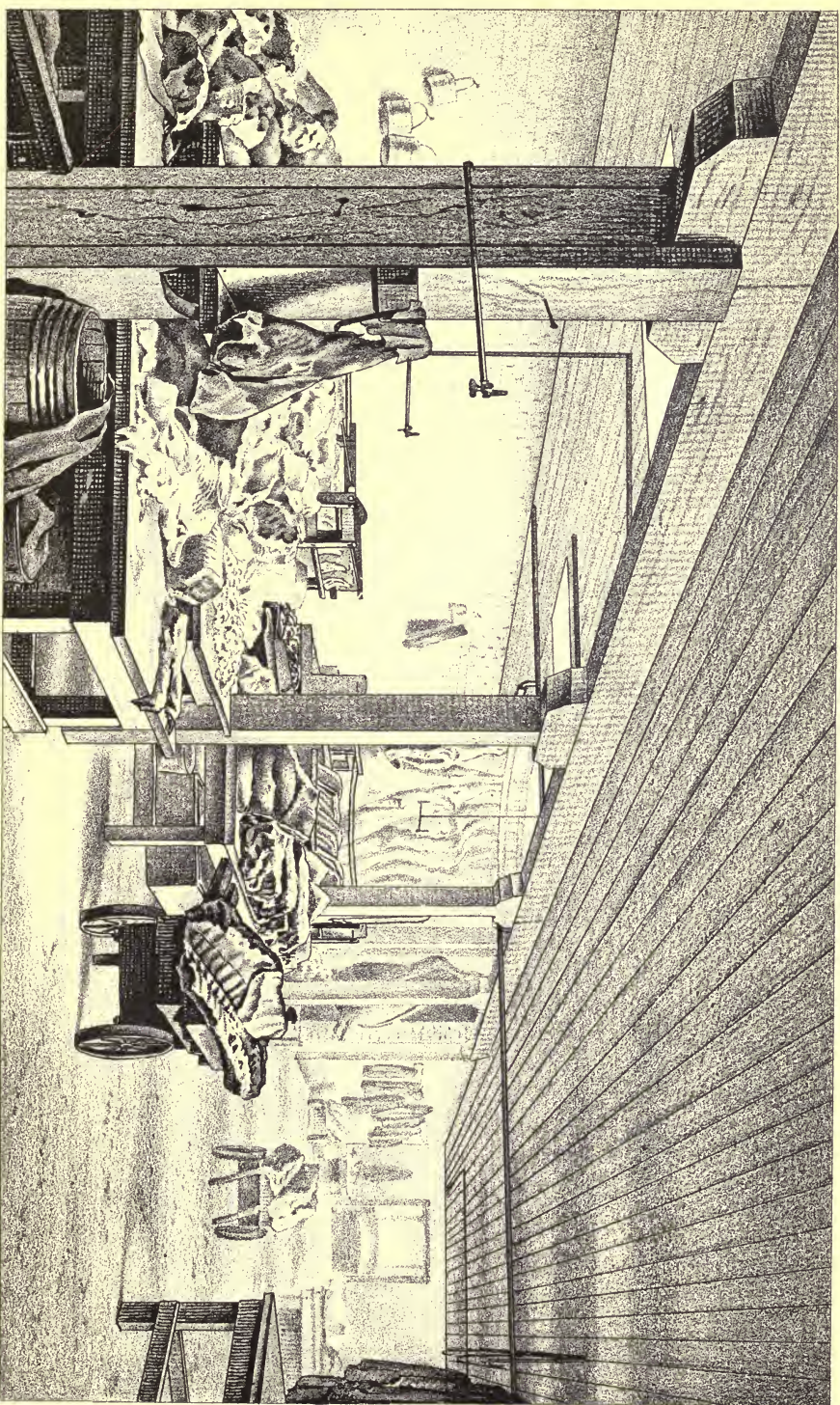


UNLOADING HOGS FROM CARS.



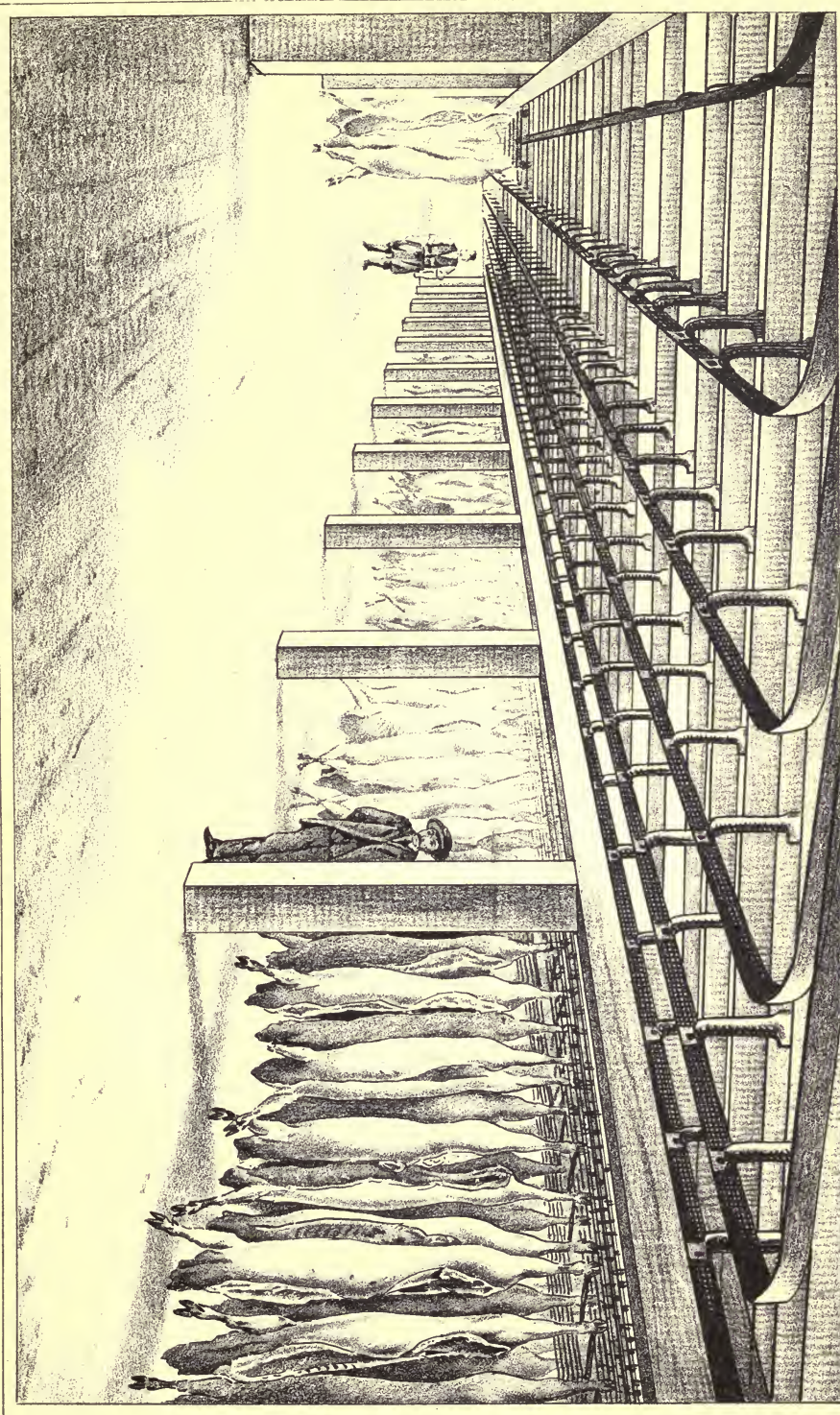


DRESSING CARCASSES OF CATTLE. E. MORRIS' SLAUGHTER HOUSE.



CUTTING UP CARCASSES OF CATTLE. ARMOUR'S SLAUGHTER HOUSE.

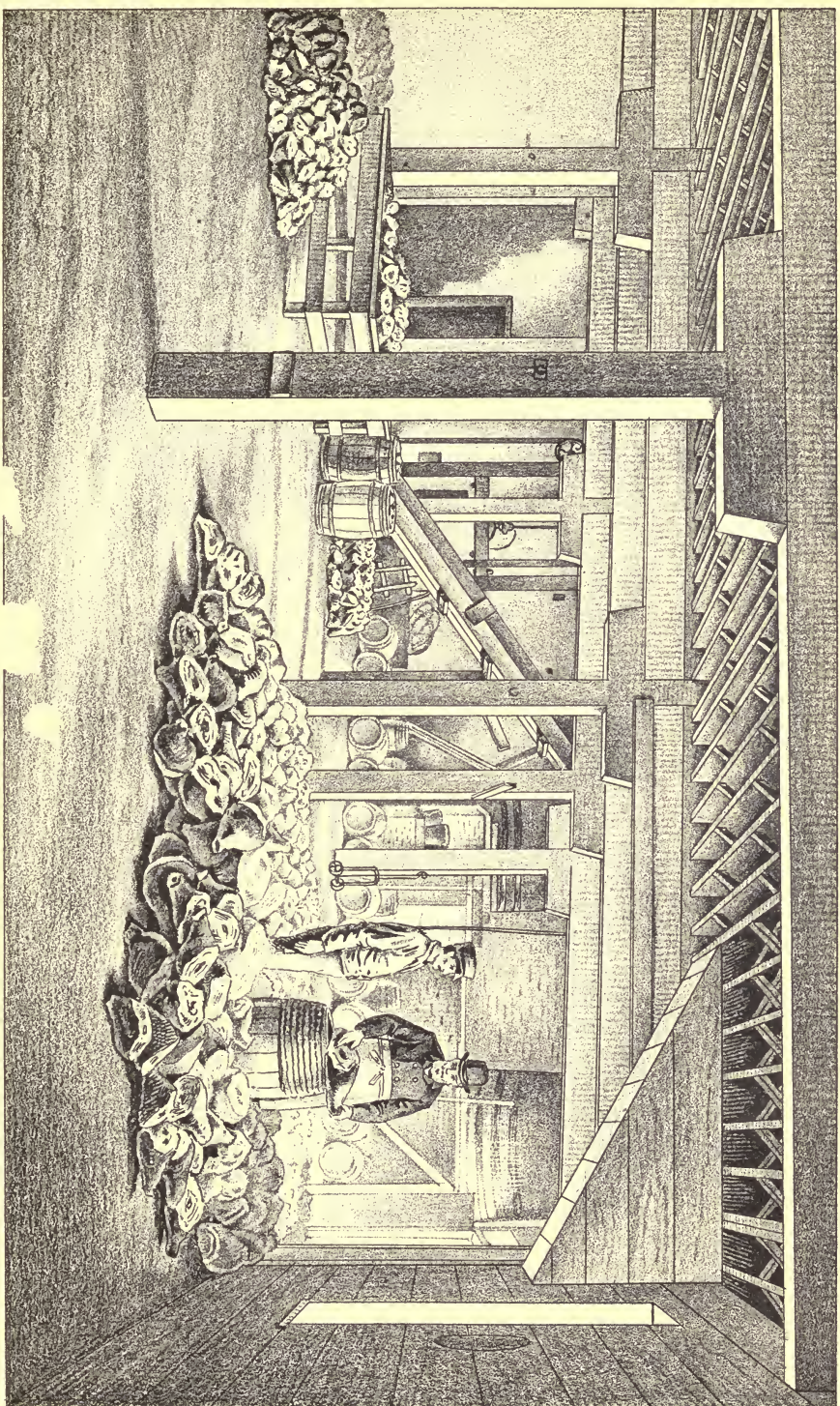


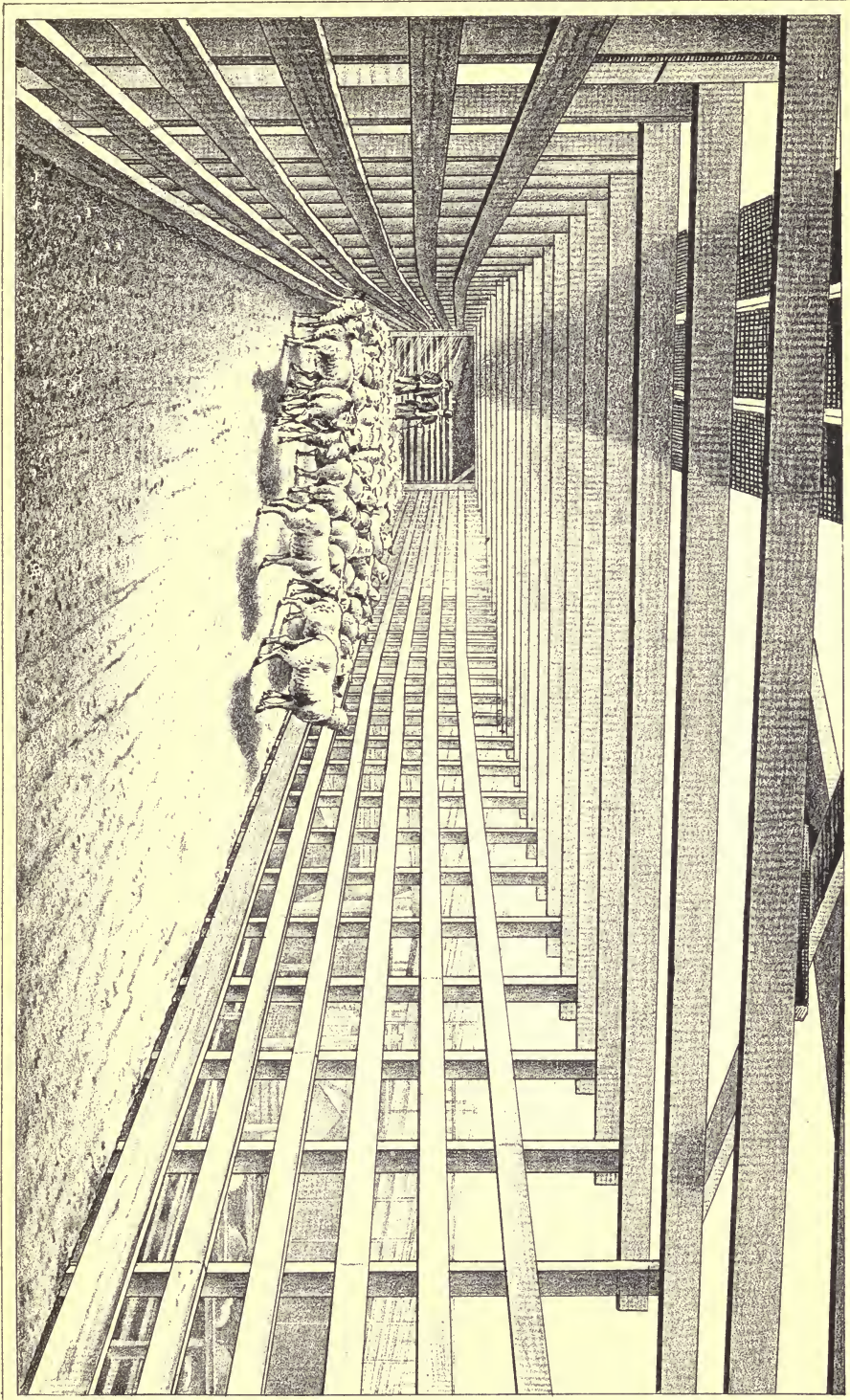




CUTTING UP CARCASSES OF HOGS. N. MORRIS' SLAUGHTER HOUSE.







That the character of the disease is such that decomposition sets in before death, and the use of the carcass, or any part of it, for human food is an impossibility.

That in no event is the disease communicable to human beings.

ASSOCIATED DAIRYING IN NEW ENGLAND.

By HERBERT MYRICK, Esq., of Massachusetts.

For upwards of two hundred years the farmers in the New England and Atlantic States manufactured at their homes all the butter they produced. The labor of making the butter was largely done by the women of the household, and constituted one of the chief if not the greatest drudgeries of farm life. Associated dairying made very slow progress at first against the home dairying custom so long established. Creameries, or factories at which whole milk or cream was received from numerous farms, and there made into butter, had been established in various parts of the country prior to 1870. But in the New England States the first creamery was organized in Hatfield in 1878. Cheese factories had been quite common all through the northeastern portion of the United States, but, except in Vermont, were not very profitable in New England, because the factories could not get a sufficient quantity of milk to run at a profit. Consequently, the creamery was viewed with little favor in New England, and predictions of its speedy demise were not few. The first creameries were started on what was called the Fairlamb plan; that is, the farmers set their milk in the so-called "Fairlamb can"—a deep can having a cover attached by a rubber rim to keep out the air. These factories were quite successful, but have since been supplanted by the Cooley system of cream-gathering butter factories. In addition to the Cooley factories, which constitute over two-thirds of the one hundred and fifty creameries in New England, there are also quite a large number of milk factories run on the separator system so common in many European countries, the Danish-Meister, DeLaval, and Backstrom separators being used. In the separator system the farmers deliver the whole milk at the factory, the cream is extracted by running through centrifugal cream separators, and the skim milk may or may not be carried back to the farm. In the Cooley cream-gathering system, however, the milk is set in deep-setting cans submerged in water. The cream-gatherer from the factory visits the farmer's house every day, skims the milk, and leaves the skim milk on the farm to be fed out. Both systems have their strong advocates, but the separator or whole-milk system is so well known that this paper is confined to a description of the cream-gathering butter factories, which, in New England, have made co-operative dairying more successful than in any other part of the country.

Instead of seeking for a proprietor to build and operate the factory, the New England dairymen insist on having it managed co-operatively. The company is organized on a co-operative basis, each shareholder (the shares are usually \$25) having as many votes as shares, and the number of shares one person can hold is limited, so as to have the stock in the hands of as many farmers as possible. This makes them all interested in the success of the creamery. The stockholders elect a

board of directors, who run the business by means of a business manager or superintendent and butter-maker, with such assistance as may be required. After paying the annual running expenses and usually laying aside a quarter of a cent per pound additional with which to create a reserve fund to meet extra expenses, the entire balance of the receipts is paid to the patrons. The expenses include 5 or 6 per cent. per annum on the capital invested in the factory, but this is the only financial advantage the patrons who are stockholders enjoy over those who are not share-owners. The capital required varies from \$2,000 to \$4,000, about \$3,000 being the average capital of our co-operative creamery companies. Where the site is given and much of the work of construction and grading voluntary, the expense of starting is less. These creameries have been so successful as to multiply rapidly during the past half dozen years, until there are about one hundred and fifty where there were none eight years ago. When the conservative nature of the New England farmer is remembered it will be seen that associated dairying must have survived severe tests to come into such general use and increasing popularity. It is not too much to say that the system is fast revolutionizing New England dairying.

The Amherst Co-operative Creamery, whose factory is located in Hampshire County, Mass., is an excellent type of these institutions. It started in 1882, amid the distrust and disadvantages common to any undertaking wholly new to farmers who have had no experience in co-operation. The original capital was \$3,000, which built and equipped an excellent factory, but, after several years, difficulty was experienced in securing perfect drainage, and it became necessary to build a new factory. This change has involved considerable extra expense, and is an exceedingly valuable object lesson to all creameries. Absolutely perfect drainage and pure water are the first requisites to a successful butter factory. Each patron is supplied with a Cooley creamer, the water in which has to be kept at a certain temperature, so that as the milk is submerged (that is, the can, cover and all, is entirely under water), all the cream is raised under essentially the same conditions and is practically equal in quality. This does away with the great inequalities that would exist if the milk were set in a variety of cans, and makes all feel that they are equally paid. To preserve the proper temperature in summer ice is used in the creameries, so that every patron must have an ice-house. This was at first regarded as a hardship, but after one summer's experience with plenty of ice no farmer's family can do without it. The creamery has been a blessing, by compelling farmers to provide ice, as well as by wholly relieving the household of the drudgery of butter making, to say nothing of the work of marketing, low prices, "store-pay," a poor product, and all the disadvantages of butter making on the average farm.

The cream-gatherer from the factory goes his rounds daily (sometimes only three times a week in bad winter weather, the patrons being allowed to skim the alternate days, and keep the cream submerged until the gatherers call for it), skimming the cream from the cans, so that all the farmer has to do is to milk his cows, strain the milk into the cans and wash them after the cream-gatherer has departed; all the rest of the labor is performed at the factory. When the gatherer arrives at the creamery he unloads his cans on the rear platform. They are carried into the receiving-room and the contents poured through strainers into the cream-tempering vats below. These vats and the room in which they are placed are so constructed

as to preserve any desired temperature, as even and uniform ripening of the cream is essential to the best product. Cream can be drawn directly into the churn, and the buttermilk from the same runs from the churn by a sewer of glazed Akron tile into the buttermilk tank twenty-five rods distant, from which it is drawn off by the farmer who buys it to feed to hogs or hens. Another long drain carries off the wash-water, while the boiler furnishes hot water and the engine does all the pumping. The butter is put almost wholly in pound prints, and sells in the neighboring markets, comparatively little surplus being tubbed and shipped to New York or Boston. Five cream-gatherers, a superintendent who is also chief butter maker, and who has one, and much of the time two assistants, and a treasurer who keeps the accounts, constitute the working force employed in the business of converting into cash the cream that makes 800 to 1,500 pounds of butter per day. The cream is all gathered within a radius of 6 miles from the factory, the longest cream route being about 20 miles for the round trip. An idea of just what is accomplished is best given by the following statement:

Business done for the past six years.

Years.	The product.			The receipts.					The expenses.		The payments.			
	Cream received.	Butter made.	Spaces of cream to make 1 pound of butter.	For butter.	For cream.	For buttermilk.	Total sales.	Receipts per pound.	Total.	Per pound of butter.	To patrons.*	Per space of cream (average).*	Per pound of butter (average).*	Average number of patrons.
	Spaces.	Pounds.						Cts.		Cts.		Cts.	Cts.	
1888	1,766,168	271,103	6.46	\$74,898	\$155	\$480	\$75,553	28.62	\$12,928	4.45	\$62,645	3.63	23.60	172
1887	1,652,639	254,894	6.47	69,339	144	492	69,974	27.45	11,208	4.40	58,766	3.55	23.05	165
1886	1,383,533	215,788	6.47	53,566	132	334	53,937	27.83	9,054	4.22	49,878	3.64	23.66	152
1885	1,037,606	160,004	6.30	43,589	183	399	44,171	23.45	7,128	4.41	37,043	3.82	24.07	120
1884	616,440	97,159	6.31	32,436	479	450	33,365	30.67	4,447	4.68	28,918	4.10	25.99	80
1883	399,324	6,776	6.36	18,496	376	393	19,265	30.54	2,840	4.59	16,426	4.09	25.95	49

* These payments are not to the patrons. No deductions or allowances are taken out of them. They show the net sum paid the patron for his cream taken at his door.

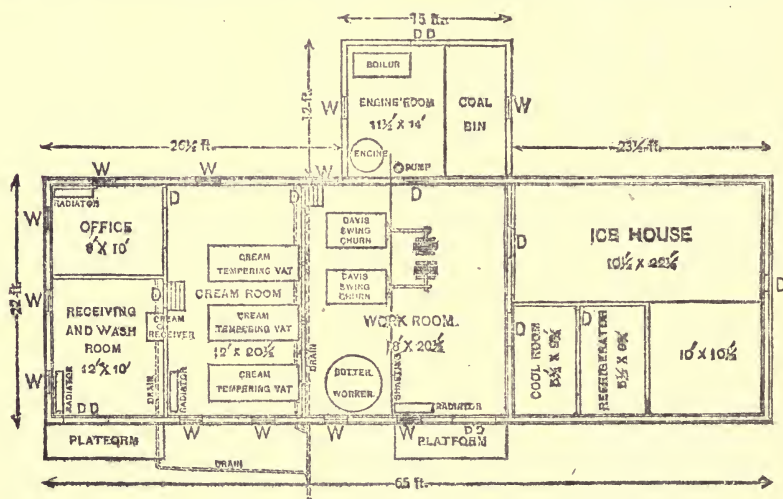
The steady increase in the business shows how well the factory has satisfied the co-operators. It is also evidence that the patrons have cheerfully complied with the regulations as to feeding of cows and caring for the stock, stables, creamers, etc.; for without this essential co-operation the product would have fallen off in quality—the beginning of misfortune. First-class butter makers, intelligent marketing, and accurate keeping of accounts have also been inseparable in the success of this and other New England co-operative creameries. In short, first-class business management is needed, such as prudent men quickly learn from experience and observation. Making butter the year through—almost as much in December and January as in June—is another key to the success of our creameries. Indeed, it may be laid down as a rule that the greatest profit in associated dairying is secured only when practically as much butter is made in winter as in summer, and if the surplus can come in January instead of in June so much the better. A statement by months of the chief items of Amherst's business will illustrate how well it carries out this

cardinal principle, and a hundred other New England creameries adopt the same policy:

Monthly reports for two years.

Month.	Amount of butter made.		Received per pound.		Expenses per pound.	
	1888.	1887.	1888.	1887.	1888.	1887.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
January.....	21,986	19,714	30.82	29.88	4.28	4.29
February.....	20,431	18,250	30.66	28.90	4.26	4.32
March.....	21,869	23,895	30.42	28.90	4.65	5.14
April.....	23,661	23,543	28.57	27.91	4.24	4.79
May.....	24,505	25,039	27.38	24.88	6.77	3.55
June.....	25,983	25,506	24.08	23.29	4.45	3.82
July.....	23,275	22,298	24.92	23.98	3.94	4.19
August.....	20,072	20,395	27.15	27.40	4.74	4.85
September.....	19,497	18,171	28.80	27.92	4.48	4.94
October.....	20,709	18,902	29.53	29.59	4.92	5.01
November.....	21,209	19,280	30.57	28.49	4.57	3.64
December.....	22,569	20,872	30.59	30.52	4.11	4.57

The construction and equipment of a modern cream-gathering butter factory are still better shown by the accompanying model of the new creamery at Schuylerville, Saratoga County, N. Y.; for it should be understood that the remarkable success of the New England creameries has led to the adoption of the system in many of the States. Now to refer to the model creamery, herewith exhibited:



PLAN OF THE SCHUYLERVILLE CREAMERY.

On the left end, as you stand facing the creamery, is the receiving-room, with a crane for raising the cans of cream and dumping them into the receiver, with a strainer, the spout of which passes through the partition and into the cream-vats in the next room towards the right. In the receiving-room also is a sink, supplied with hot and cold water, and a steam jet for washing the cans and steaming them out without taking them into any other part of the creamery. This is an important aid in preserving the strictest cleanliness throughout the factory. The sink is connected with the drain.

Back of the receiving-room is the office, connected by a door with the receiving-room, and also connected with the cream-room by a door.

To the right of the receiving-room is the cream-room, in which the cream-tempering vats stand. There are two cream-vats in the model, their ends projecting through the partition between the cream-room and the work-room. They are fitted with pipes for running water, and also with steam and overflow pipes. These vats are of 250 to 500 gallons capacity, and as many are used as are required to hold the supply of cream. These vats play an important part in butter making, as in them the cream is "ripened" at precisely the proper temperature, which varies with the age of the cream. The temperature is regulated by letting steam or cold water into the space or double walls surrounding the vats.

Next to the right of the cream-room is the work-room above mentioned, which contains a Davis swing churn and a Cooley power worker. This worker is a circular table, with two smooth rollers. Most workers that run by power have corrugated rollers; this one is comparatively new and is being watched with interest. The rollers are fitted so as to automatically rise and fall with the thickness of the butter. In this room are the table, with butter-bowl and ladles, and the sink, furnished with hot and cold water, for washing anything that needs to be washed. The floor drains into a gutter on one side, which connects with the drains.

Special attention should be given to the construction of the floor in the work-room. It should be of an impervious cement with a slate finish; that is, with a coating that will be as smooth, hard, and impervious as slate. This material will never soak up buttermilk, and can always be kept clean by frequent washings. This point is absolutely essential to the perfect cleanliness which must be constantly maintained in every department of the butter factory. Great care should be taken also that the work-room in particular is well lighted, especially to insure cleanliness.

Next to the right of the work-room are the refrigerator-rooms and the ice-house. The plan illustrated in the model is used in a number of creameries with great success, and may be varied in size to suit the requirements of the builder. In the Schuylerville creamery, which is illustrated by the model, the cold-storage or refrigerator-room is 10 by 12 feet in size and divided equally by a partition into two compartments, each $5\frac{1}{2}$ by $9\frac{1}{2}$ feet, the first being styled the cool-room, and beyond is the refrigerator proper. An ice-box 4 feet square and 12 feet long is put over the room and connected with the room below by flues constructed in the wall. These flues may be simply the space between the studs and joists, and must receive the air from the ceiling on the side of the room next to the ice, and be connected with the top of the ice-box. These flues carry the warm air, which rises to the ceiling, into the ice-box. From the sides, at the bottom of the ice-box, other flues run to within 6 inches of the floor of the refrigerator and enter the rooms, one in each room. These carry the heavy air, after it has cooled in the ice-box, to the room below. A slide should be put in the flue conducting the cold air from the ice-box to the floor, so as to regulate the temperature or cut off the cold air entirely. The rooms must be tight, so that no air can enter them from the outside, and great care must be taken to have the flues tight, so that no air will enter them except from the ice-box and the ceilings of the storage-rooms. The ice-box must be lined with galvanized iron, and a drip-pipe provided to carry

off the water from the melting of the ice. This drip-pipe must be arranged so that no air can enter it from the bottom.

The ice-box has a partition across it corresponding to the partition in the storage-room. There must be a thick cover fitting tightly to the box where the ice is put in. This cover should be made in two sections, one for each side of the partition. The ceiling over the cold-rooms, which is not covered with the ice-box, should be covered with galvanized iron, laid so as to run the water from the melting ice into a drain. This pipe also must be arranged so that no air can get into the lower end. Paper should be put in under the galvanized iron everywhere to prevent condensation and consequent drip. Too much care can not be taken that everything is tight about the cold storage, especially the flues and doors. In large creameries where this method of building refrigerators is in use, the air in the refrigerators is so dry that a match can be lighted on any part of the walls. This dryness is an important point in keeping butter, for in a moist refrigerator it will be likely to be contaminated. The rest of the creamery building beyond the refrigerator, a space 10 by 10½, with the large space in front of the refrigerator, 10½ by 22½ feet, is used as an ice-house and is stored full of ice in winter. The construction of the outside walls of the ice-house is the same as for the rest of the main building. The inside walls are sheathed to the upper floor joists, above which the space is left open for ventilating purposes. The bottom of the ice-house is arranged to give good drainage, so that the drip from the ice is carried outside the building. The ice is piled within 8 or 12 inches of the walls, which space is filled with sawdust or other packing. A foot of the sawdust, or 2 feet of meadow hay or straw chaff on top, completes the care of the ice.

Back of the main building is an L containing an engine-room 11½ by 14 feet, and also a coal bin. The illustration shows the arrangement of the entire structure, which is 65 feet long by 32 feet wide. Such a building can be put up for from \$800 to \$1,500, according to locality and finish. It is large enough to accommodate the cream of from 1,000 to 1,500 cows; and by economy of space will accommodate the cream from 2,000 cows. The cost of the boiler, engine, cream-vats, churns, etc., will be from \$750 to \$1,000. This expense is borne by the creamery company. In addition, each patron has to obtain the creamer in which the cans containing the milk are submerged beneath the water, having a cover which operates on the principle of the diving-bell, to keep out the water. The entire expense of such a factory and the entire outfit will be from \$2 to \$5 per cow, the price depending largely upon the style of the apparatus selected and the producing powers of the cows. Here, as in the operating expenses, the more business done the less the total cost per pound of product.

The advantages of this form of construction, which is the evolution of the creamery after years of experience, are several fold. In the first place, this is the cheapest form to build; second, it is very convenient; third, it permits of a tenement being built above the creamery or basement used for the factory; and fourth, it places the engine and boiler and coal bin, with their accompanying heat and dirt, in a cheap L entirely apart from the main building. A storage-room or basement may also be put under the receiving-room and office.

The creamery is built on a stone or brick foundation, with sills 6 by 8 inches. The wall on the front side, for a length of 24 feet, is

raised 3 feet higher than under the rest of the building, so that it may be graded up to raise the cream-wagons on a level with the receiving-platform. Of course, if built in a side hill, no such grading will be required. The joists of the elevated floor are 2 by 8 inches in size, spiked to studs and supported in the center by 4 by 6 timbers, shored up on pillars. The ends are shored up by 2 by 4 studs. The outside walls have 2 by 4 studs 14 feet long. On these are nailed rough 1-inch boards, to which building paper is tacked, and over this 1-inch strips or battened siding or clapboards are nailed. On the inside of the studs rough boards are nailed, then paper, furred out with inch strips and ceiled with seasoned sheathings, clear white pine or white-wood, with a shellac finish, being best. This leaves three air spaces. In case it is desired to save the expense of rough boarding tack the paper to the sides and fur out 1 inch, then ceil and side as above. For the partitions, set the studs flatways and ceil on both sides of the studs, leaving a 2-inch air space.

THE LESSONS OF EXPERIENCE.

Average creamery butter brings at wholesale from 3 cents to 6 cents more per pound than average dairy butter. Suppose one hundred farmers, with ten cows each, making their butter at home (with all the drudgery this implies) average 150 pounds of butter per cow per year, for which 20 cents is received, making the receipts per cow \$30 per year for the butter alone. Let these same farmers organize a co-operative cream-gathering butter factory and they will net 22 cents to 25 cents per pound for their butter and get more per cow—at least 170 pounds—thus receiving \$38 to \$43 per cow per year with none of the work of butter making or selling. This is a mild estimate. It has been exceeded in many cases. Many farmers get \$50 to \$75 per cow per year net for their cream alone, and instances of \$90 to \$100 (including the skim milk) are well attested.

The co-operative or mutual feature of several of these creameries is emphasized by sending to each stockholder a monthly itemized statement of the expenses, showing just where every cent goes. These circulars cost a trifle, and enable a stockholder to keep himself informed. If he is dissatisfied with anything, he can find fault with it directly, and thus extravagance and errors are guarded against.

As to the average returns of the New England cream-gathering butter factories, it was stated at the meeting of the Connecticut State board of agriculture at Danbury, in December, 1888, that where the patrons of these creameries were unable to sell the skim milk, and kept it at home, the return they received for their butter was equivalent to $2\frac{1}{4}$ cents per quart for all the milk they used in producing cream. That is to say, the well-managed co-operative creameries take the cream at the farmer's door, manufacture it, sell the butter, and return him enough from the butter made from his cream to be equal to $2\frac{1}{4}$ cents for every quart of milk set to raise that cream. This is the average of the entire year. Some creameries do much better and a few fall below this. Moreover, the farmer has the skim milk left on his farm to either feed or sell. With the most careless feeding, the skim milk is worth one-fourth of a cent per quart to feed, so that at the lowest calculation the *creamery patron nets three cents per quart for the milk, without robbing the farm of the plant food in the milk.* The farmer also has none of the work of butter making and selling, and does not have to deliver his milk or cream.

Another advantage of the creamery system is that the patrons are led to keep a better quality of cows. The cows are necessarily tested as to their cream-producing qualities. No farmer will keep a cow that gives only five or six spaces of cream daily when on the same feed another cow will produce eight or ten spaces of cream daily. The cows are better fed, better cared for, and more cleanliness about the stable is observed where there is a good creamery. It also provides an outlet for all the milk that can be produced and at a remunerative price. This encourages the keeping of all the cows that the farm is capable of, and also the increasing of the number of cows as the farm improves. This means more manure, and that means more grass and more feed and consequently richer and more productive farms.

A good location is of paramount importance. A mistake here is beyond remedy. A dry soil, good drainage, good spring water, a northern exposure of the work-rooms, a ground floor and convenience to the highway, railroad depot, and express office, are features to be borne in mind in locating a factory.

The greater the number of pounds of butter made from the same outfit or creamery plant the less the actual expense per pound of butter. Thus the co-operative creamery at Windsor, Conn., made in 1888 30½ per cent. more butter than in 1887, paid its patrons 12½ per cent. more per pound, and the total expenses were only 9 per cent. more, while really less per pound.

It takes from 20 to 23 pounds of milk by this system to make 1 pound of butter. The dairies furnishing cream to the Wapping (Connecticut) Creamery average 12 spaces of cream on 17 quarts of milk, and the milk will weigh 36.83 pounds. The average number of spaces required for a pound of butter at this factory last year was 6.51 spaces, so that the average amount of milk required for a pound of butter was only 20 pounds at the Wapping Creamery. A number of other co-operative creameries probably do as well, but this is believed to be above the average.

A fair sample of the way in which these co-operative butter factories increase their business is also shown by the experience of the Ellington (Connecticut) factory. When it began business in 1884 it had only twenty patrons, and at first made only 79 pounds of butter per day. It now has nearly one hundred patrons, and last year made as high as 1,000 pounds of butter daily. The following is a statement of a summary of each year's business:

Year.	Butter made.	Cream to make 1 pound of butter.	Total expenses per pound of butter made.	Average payment net to patrons for each pound of butter made.	Average paid patrons per space for cream.	Total expenses of the creamery.	Total receipts for the year.
	Pounds.	Spaces.	Cents.	Cents.	Cents.		
1888.....	203,834	6.51	4.32	25.86	3.06	\$8,775.34	\$60,864.25
1887.....	149,097	6.56	4.88	24.18	3.09	7,200.84	43,399.48
1886.....	118,107	6.41	5.31	22.41	3.49	6,183.43	31,102.00
1885.....	80,672	6.28	6.52	20.69	3.81	5,261.11	21,719.93
1884.....	15,737	6.23	9.74	21.29	3.37	1,532.78	4,626.92

Certain remarkable points in this record deserve to be emphasized. Notice that with increased business there has been a constant reduction in the average expenses per pound of butter produced, and that in 1888 the expenses per pound were over 50 per cent. less than in

1885, while the production increased 150 per cent. The fact that an average of about 26 cents per pound was returned to the patron for the butter in 1888 shows that the product must have been of the very highest quality, for it averaged over 30 cents per pound during the entire year. Indeed, this factory claims the distinction of commanding the top of the market and selling on the average for a higher price than any other creamery in the Eastern States. Its product in December, 1888, and January, 1889, sold as high as 38 cents per pound. While the increased business reduced the expenses to less than 4½ cents per pound, it should be noted that the total expenses of the creamery in 1888 were only about 62 per cent. greater than the expenses in 1885, while the product in 1888 was 150 per cent. more than the product of 1885. In other words, the ratio of expense to increase of business was as 1 to 2, emphasizing most clearly the benefits of doing as large a business as the plant will accommodate.

The following is a statement of the business of the Ellington Creamery, by months, for the year 1888:

Months.	Cream received.	Butter made.	Cream required to make 1 pound of butter.	Paid patrons net space for cream.	What this payment per space was equal to per pound of butter.	Total sales.	Net payment to patrons.	Total expenses.	Expenses per pound.
	<i>Spaces.</i>	<i>Pounds.</i>	<i>Spaces.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Dollars.</i>	<i>Cents.</i>
January	95,095	14,834	6.41	4.38	28.09	4,829.35	4,160.40	668.96	4.50
February	90,535	14,438	6.27	4.50	28.22	4,719.67	4,073.62	619.29	4.50
March	97,190	15,158	6.40	4.37	28.08	4,933.33	4,249.44	678.82	4.48
April	111,117	16,393	6.70	4.13	28.06	5,264.84	4,615.57	746.22	4.44
May	135,309	21,049	6.42	3.65	23.72	5,821.02	4,935.12	838.68	3.92
June	139,218	21,304	6.53	3.13	20.27	5,171.32	4,350.56	820.66	3.79
July	121,422	18,594	6.45	3.12	20.55	4,554.85	3,794.67	745.77	4.02
August	108,505	16,354	6.43	3.50	22.08	4,535.99	3,797.67	728.86	4.27
September	110,976	17,041	6.51	3.90	25.52	5,057.12	4,338.06	748.58	4.39
October	118,759	17,956	6.61	4.15	27.56	5,711.57	4,928.49	783.08	4.25
November	94,523	13,998	6.75	4.13	27.84	4,618.16	3,899.07	715.90	5.11
December	108,208	16,285	6.64	4.50	29.70	5,518.17	4,837.11	681.06	4.18
Total	1,331,347	203,834	*6.51	*3.96	*25.86	60,864.25	51,969.54	8,775.38	*4.82

*Average.

The following is a statement of the business of the Wapping (Connecticut) Creamery and Butter Factory, by months, for the year 1888:

Months.	Cream received.	Butter made.	Cream to make 1 pound of butter.	Paid per space to patrons.	Equal per pound for butter net paid patrons.	Expense per pound of butter making, express, etc.
	<i>Spaces.</i>	<i>Pounds.</i>	<i>Spaces.</i>	<i>Cent.</i>	<i>Cent.</i>	<i>Cent.</i>
January	89,365	13,175	6.76	.0425	.2873	.0527
February	90,438	13,494	6.68	.0425	.2840	.0497
March	97,769	15,450	6.32	.0425	.2686	.0474
April	98,638	14,959	6.59	.0400	.2636	.0503
May	116,470	18,222	6.37	.0370	.2364	.0457
June	120,893	18,614	6.49	.0325	.2109	.0424
July	109,553	17,063	6.42	.0325	.2086	.0433
August	100,316	15,399	6.51	.0350	.2278	.0466
September	96,838	14,330	6.75	.0370	.2497	.0464
October	90,990	14,512	6.27	.0410	.2570	.0490
November	74,056	11,188	6.62	.0410	.2614	.0550
December	84,759	12,001	6.72	.04	.2688	.0475
Total	1,170,108	179,002	6.33	.038625	.2522	.0479

Ninety-five patrons, 850 cows.

Note the amount of butter made in the winter months and the high prices received. Also the average product per cow of about 225 pounds of butter per year, or over \$55 per cow net annually. Also note that each patron received in the average \$500 net for his cream in 1888, and had the skim milk to feed or sell.

Further reports from these creameries, taken from the New England Homestead of Springfield, Mass., show that the instances above quoted are not exceptional:

Monthly reports for October, November, and December, 1888, and January, 1889.

Colchester (Connecticut) Creamery received in November 29,636 Cooley spaces of cream and made 4,268 pounds of butter, all of which sold at 28 to 32 cents per pound. The average cost of manufacture was 7.44 cents per pound. Patrons received $3\frac{1}{2}$ cents per space for cream, equivalent to 24.29 cents per pound for butter.

Ipswich (Massachusetts) Creamery received in October 43,868 Cooley spaces of cream and made 6,560 pounds of butter. Paid patrons 4 cents per space for cream, equivalent to 26.72 cents per pound for butter. It required 6.68 spaces of cream per pound of butter. Received in November 39,769 spaces of cream and made 5,933 pounds of butter, all of which sold. Patrons received 4 cents per space for cream, equivalent to 26 $\frac{1}{2}$ cents per pound for butter. It required 6.7 spaces of cream per pound of butter.

Glastonbury (Connecticut) Creamery received in November 37,690 Cooley spaces of cream and made 3,433 pounds of butter, all of which sold at 29 to 32 cents per pound. The average cost of manufacture was 5 $\frac{1}{2}$ cents per pound. Patrons received 3.8 cents per space for cream, equivalent to 26 $\frac{1}{2}$ cents per pound for butter.

Canton (Connecticut) Creamery received in November 80,227 Cooley spaces of cream and made 12,442 pounds of butter, all of which sold. Patrons received 4 $\frac{1}{2}$ cents per space for cream, equivalent to 26.56 cents per pound for butter.

Windsor (Connecticut) Creamery received in November 46,169 Cooley spaces of cream and made 6,860 pounds of butter, all of which sold. Patrons received 3 $\frac{3}{4}$ cents per space for cream, equivalent to 26 cents per pound for the butter. It required 6.7 spaces of cream per pound of butter.

Contoocook Valley Creamery of Henniker, N. H., made in December 4,472 pounds of butter, all of which sold at 27 to 35 cents per pound. The average cost of manufacture was 4.58 cents per pound. Patrons received \$1,207.65 for cream furnished, equivalent to 27 cents per pound for butter.

Conway (Massachusetts) Creamery received in December 180,385 Cooley spaces of cream and made 28,794 pounds of butter, all of which sold at 25 to 34 cents per pound. The average cost of manufacture was 3.69 cents per pound. Patrons received 4.1 cents per space for cream.

North River Creamery of Whitingham, Vt., received in December 28,161 Cooley spaces of cream and made 4,152 pounds of butter, all of which sold at 28 to 30 cents per pound. The average cost of manufacture was 4 $\frac{1}{2}$ cents per pound. Patrons received 3 $\frac{1}{2}$ cents per space for cream, equivalent to 23.8 cents per pound for butter. It required 6.8 spaces of cream per pound of butter.

Hampton Creamery of Easthampton, Mass., received in December 47,163 Cooley spaces of cream and made 7,450 pounds of butter, all of which sold at 26 cents per pound net at creamery. Patrons received 4.1 cents per space for cream, equivalent to 26 cents per pound for butter. Average cost of manufacture 3.81 cents per pound.

Riverside Creamery of Enfield, Conn., received in November 19,571 Cooley spaces of cream, and made 2,978 pounds of butter. Patrons received 3 $\frac{1}{2}$ cents per space for cream. The first butter made by the creamery was on November 1, and the payment for cream for the first month's business is very gratifying to the management. The December showing is even better.

Cummington (Massachusetts) Creamery received in November 50,681 $\frac{1}{2}$ Cooley spaces of cream and made 7,813 pounds of butter, all of which sold at 28 to 31 cents per pound. The average cost of manufacture was 3.42 cents per pound. Patrons received 3.7 cents per space for cream, equivalent to 24.05 cents per pound for butter.

East Granby (Connecticut) Creamery received in November 36,293 Cooley spaces of cream and made 4,739 pounds of butter, all of which sold, besides selling 2,606 spaces of cream. Average cost of manufacture 4 $\frac{1}{2}$ cents per pound. Patrons received 3.6 cents per space for cream, equivalent to 25 cents per pound for butter.

La Grange (New York) Creamery received in December 32,245 Cooley spaces of

cream and made 4,765 pounds of butter, all of which sold at 33½ cents per pound at creamery. Patrons received 4½ cents per space for cream, equivalent to about 28.76 cents per pound for butter. Average cost of manufacture 4.76 cents per pound.

Canton (Connecticut) Creamery received in December 87,299 Cooley spaces of cream and made 13,480 pounds of butter. Patrons received 4½ cents per space for cream, equivalent to 26.69 cents per pound for butter.

Colchester (Connecticut) Creamery received in December 30,088 Cooley spaces of cream and made 4,184 pounds of butter; sold 4,180 pounds at 28 to 33 cents per pound. Average cost of manufacture 7.59 cents per pound. Patrons received 3½ cents per space for cream, equivalent to 25.16 cents per pound for butter. It required 7.19 spaces of cream to make 1 pound of butter.

Annual reports for 1888.

Conway (Massachusetts) Creamery received in the twelve months ended January 1, 1,409,972 Cooley spaces of cream and made 229,352 pounds of butter. The average cost of manufacture was 4.15 cents per pound. Average price paid patrons for cream 3.912 cents per space.

Windsor (Connecticut) Creamery received in the twelve months ended January 1, 663,078 Cooley spaces of cream and made 102,725 pounds of butter. The patrons received an average of 3.73 cents per space for cream, equivalent to 24.29 cents per pound for butter. The average spaces of cream required per pound of butter were 6.49. The total average cost of manufacture, selling, etc., was 5½ cents per pound. The highest price paid for cream was 4½ cents for October cream, and the lowest was 3½ cents for June cream.

The LeGrange Creamery near Poughkeepsie, N. Y., had sales of \$18,048.66 for the year 1888. Its expenses were only \$2,884.55, and it returned the patrons \$15,164.11. The business of the creamery by months is presented below, showing that the average price returned to patrons was over 25 cents per pound for the whole year. It took 6.62 spaces as the average for the year to make a pound of butter, varying from 6.21 to 6.9; the butter sold at 26½ to 34½ cents, averaging 30½ cents.

Months.	Cream.	Butter.	Paid per space.	Paid per pound.	Expenses per pound.
	<i>Spaces.</i>	<i>Pounds.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>
January	15,616	2,263	3.87	26.14	7.72
February	15,605	2,498	4.25	27.06	7.00
March	19,875	3,047	4.00	37.74	5.76
April	21,770	3,507	4.00	26.56	5.58
May	35,759	5,406	3.50	24.00	4.34
June	48,941	7,121	3.33	22.91	3.79
July	47,212	7,059	3.50	24.47	3.80
August	43,994	6,910	3.50	23.16	4.00
September	41,302	6,236	3.40	22.51	4.00
October	41,797	6,252	3.50	23.40	4.00
November	31,978	4,601	3.66	25.73	4.90
December	32,245	4,765	4.25	28.76	4.74
Total	396,094	59,665	3.73	25.24	4.97

The following statement shows the business of the co-operative cream-gathering butter factory at Ipswich, Mass., for 1888. This factory is in a milk-shipping section, but it will be noticed that it returned its patrons a net price (within a fraction) of 26½ cents per pound for every pound of butter made during the year. As it did not take over 20 pounds of milk to make 1 pound of butter at this factory, this payment is equivalent to nearly 1½ cents per pound of milk, or between 2½ and 3 cents per quart for the milk from the cream alone, leaving the skim milk on the farm. Farmers who sell whole milk to the contractors who ship to large city markets do not receive on the average much over this price. Indeed, an average of three cents per quart for whole milk the year round is above the average prices paid to farmers who supply the cities of Boston and New York. Consequently, this factory and others that have been

similarly successful, pay their patrons nearly as much for *the cream alone* as the wholesale market pays for *whole milk*. Besides this, the farmer has the skim milk to feed or sell, and if a stockholder in the creamery he gets 5 or 6 per cent. interest on the stock. The following is a statement of the business of this factory for 1888:

Ipswich, Massachusetts, Creamery.

1888.	Butter made.	Spaces per pound.	Expenses per pound.	Paid patrons per pound.	Paid patrons per space.	Total expenses.	Total receipts.
	<i>Pounds.</i>		<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>	<i>Dollars.</i>	<i>Dollars.</i>
January	5,424	6.78	6.19	28.81	4½	333.74	1,905.97
February	5,302	6.63	5.23	28.17	4½	281.00	1,802.18
March	6,089	6.73	4.40	28.60	4½	267.91	2,064.99
April	6,798	6.56	5.07	27.88	4½	344.65	2,175.71
May	8,289	6.05	5.02	24.20	4	417.11	2,468.51
June	9,790	6.24	3.04	24.96	4	297.61	2,741.50
July	8,784	6.27	4.19	23.51	3½	668.04	2,435.92
August	7,565	6.14	5.44	21.56	4	411.53	2,274.56
September	6,890	6.28	5.48	25.12	4	374.28	2,089.79
October	6,560	6.68	4.18	26.72	4	274.21	2,063.43
November	5,933	6.70	6.10	26.80	4	361.91	1,902.13
December	5,943	6.98	4.85	27.92	4	288.23	1,959.46
Total	83,797					4,017.22	25,884.15
Average		6.50	4.93	26.44	4.06		

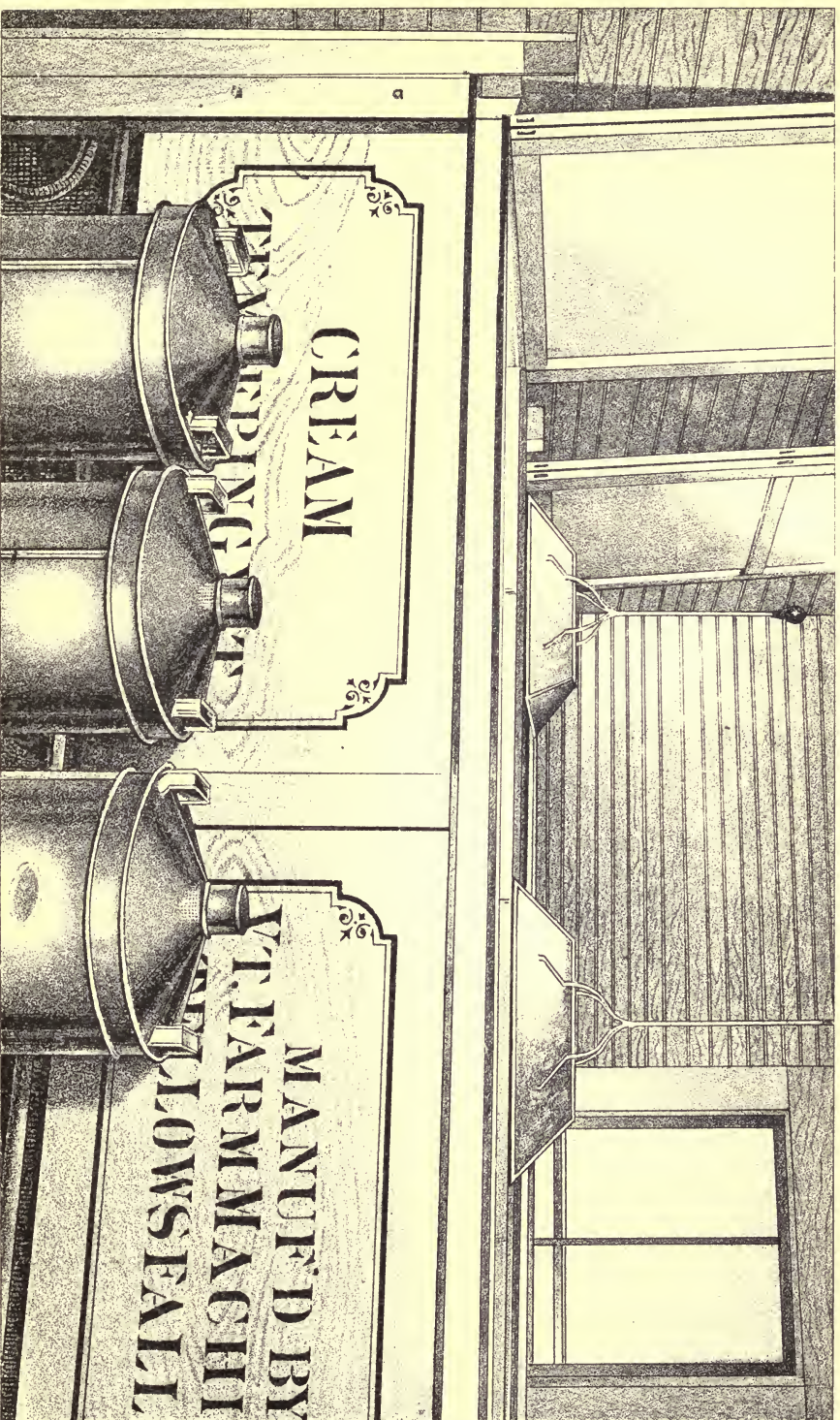
The White Mountain Creamery, at Littleton, N. H., has a building 22 by 52 feet, with studs 14 feet high. The cellar is 9 feet, with a stone wall, except at the left-hand end, which contains the ice-house. The **L** contains the engine, boiler, sinks, etc. The main floor is divided into six rooms, much in the same style as the model. The refrigerator in this creamery is specially noticeable. In the partition which forms the front wall to the refrigerator, between the refrigerator and the work-room, there are eighteen small doors, which open into as many compartments, 18 inches wide, 30 inches deep, 10 inches high. In each of these are five hard-wood rollers that extend across the compartment. These rollers permit the boards to be put in and taken out easily. The print butter is placed on these boards for cooling and storage until packed in the cases for shipping. Below these compartments are four larger openings through which the bowls of butter are put into the refrigerator for cooling after the first working. It can readily be seen that these conveniences save the butter maker many steps and much labor. This is a new creamery that began operations in May, 1888. It is located among the White Mountains of northern New Hampshire, where it has been claimed the cream-gathering system could not work. The business done is shown in the following statement:

In June received 67,208 spaces of cream and paid 3 cents per space.
 In July received 70,718½ spaces of cream and paid 2½ cents per space.
 In August received 49,972½ spaces of cream and paid 3 cents per space.
 In September received 42,504½ spaces of cream and paid 3 cents per space.
 In October received 38,269½ spaces of cream and paid 3 cents per space.

There was a small run in November, for which 3 cents per space of cream received was paid. The creamery began with forty-three patrons, and within three weeks increased to seventy-five, making between 400 and 500 pounds of butter daily. The illustrations show a number of points of interest in this factory.

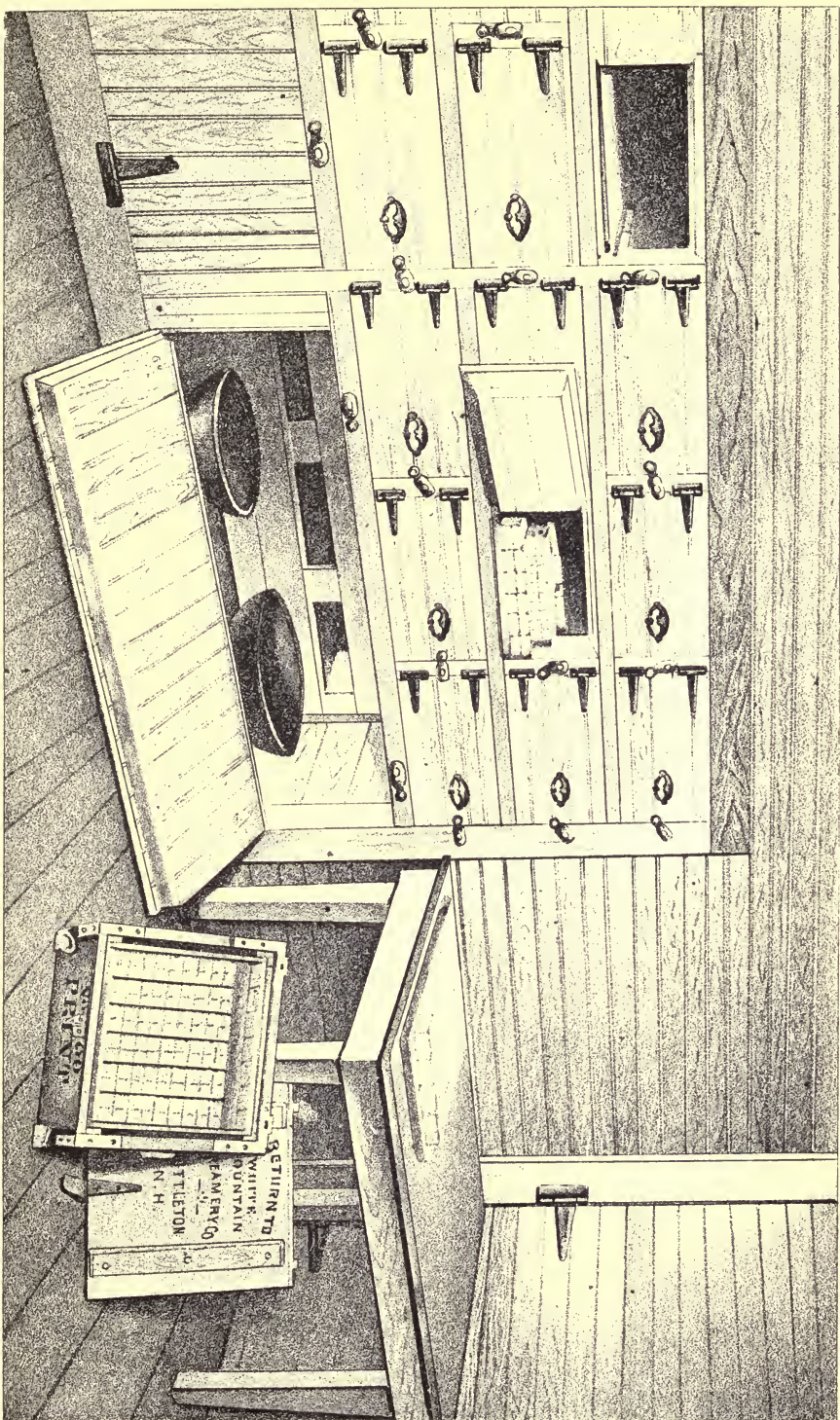


WHITE MOUNTAIN CREAMERY, LITTLETON, N. H.



WHITE MOUNTAIN CREAMERY, LITTLETON, N. H. SECTION OF CREAM ROOM SHOWING TANKS.

A detailed black and white illustration of a large industrial machine, likely a steam engine or pump, mounted on a wooden platform. The machine features a large flywheel on the left side and a complex arrangement of pipes, valves, and structural beams. A sign on the front of the machine reads "SINKING COMPANY" and "BELL'S PATENT STEAM WATER LIFTING MACHINE". Another sign on the right side of the machine says "RETURN TO WHITE MOUNTAIN CEMENT CO. LITTLETON N.H.". The background shows a building with windows and doors.



THE DAIRY INDUSTRY OF THE UNITED STATES.

By H. H. WING, Esq.

In a country of so great extent and with so many varieties of soil and climate as the United States, it is not to be expected that the various industries will be equally developed over the whole country, but that each will be most extensive and best developed in those places where the soil, climate and other natural conditions are most favorable. Consequently, we find that while cows are kept in large numbers, and while milk, butter, and cheese are produced in considerable quantities in all parts of the country, there are certain favored localities where this industry is the leading if not the sole occupation of the agricultural community.

These distinctively dairy regions are all in the more northerly portions of the country, but they extend from east to west as far as the country has been settled. The climate is the climate of the colder part of the temperate zone; the soil is generally fertile though often hilly, and is well adapted to the growth of the grasses; and there is an abundance of pure water from either wells, springs, or running streams. In the States of New York, Wisconsin, Vermont, Iowa, and part of Minnesota, dairying is the leading agricultural industry, while in the States of Maine, Massachusetts, Pennsylvania, Ohio, Michigan, Missouri, and Nebraska, and the Territory of Dakota, it forms a very important part of farm practice.

The distribution of milch cows will give a very accurate idea of the extent of dairying in the different parts of the country. The latest available returns are those made to the Department of Agriculture in January, 1888, a summary of which is given below:

State.	Milch cows.	Average value per head.	State.	Milch cows.	Average value per head.
	<i>Number.</i>	<i>Dollars.</i>		<i>Number.</i>	<i>Dollars.</i>
New York	1,540,053	30.50	Kansas	640,081	22.41
Iowa	1,253,432	23.30	Indiana	556,961	27.75
Illinois	937,476	26.50	Wisconsin	548,222	23.83
Pennsylvania	929,371	28.60	Thirty seven other States		
Ohio	783,481	20.20	and Territories	6,155,362	.....
Texas	772,716	14.20			
Missouri	737,259	20.25	Total in United States.	14,856,414	24.65

It will be seen that about four-sevenths of the cows are found in ten States. Some of these States, as Missouri and Texas, are not, however, distinctively dairy States, but make a large showing in numbers of milch cows because stock growing is an important industry in those States, and cows that are running at large on the range and suckling calves are classed as milch cows, while as a matter of fact but very few of them are ever milked at all.

In the following table the States are arranged in the order of the largest percentage of milch cows in relation to other cattle. It gives a rather better idea of the States that are most extensively engaged in dairying. Several small States that did not appear at all in the other table will be found quite well up in this. In this table are given only the States included in the first table, and such other

States in which more than 50 per cent. of all the cattle are milch cows:

Rank.	State.	Milch cows.		Average value per head.
		Number.	Percentage.	
1	New Jersey	178, 114	72	\$35. 92
2	New York	1, 540, 053	64	30. 50
3	Massachusetts	180, 319	63	34. 17
4	Rhode Island	22, 883	63	35. 75
5	Vermont	225, 552	56	28. 70
6	Connecticut	127, 153	54	33. 71
7	Pennsylvania	929, 371	52	28. 60
8	Delaware	28, 683	51	30. 00
9	Wisconsin	548, 222	46	23. 83
10	Ohio	783, 481	45	23. 20
11	Illinois	937, 476	39	26. 50
12	Indiana	556, 961	38	27. 75
13	Iowa	1, 255, 432	37	23. 30
14	Missouri	737, 259	34	20. 25
15	Kansas	640, 081	20	22. 41
16	Texas	772, 716	11	14. 20

The States included in the above table fall quite naturally into three groups, so far as their dairy industry is concerned.

The first, comprising the States down to and including Delaware, is made up entirely of Eastern States. Many of them are quite small in area, and the surface in all is more or less broken and hilly. The live-stock industry is almost wholly devoted to dairying, and as a consequence of the total number a very large proportion of the cattle are cows. An important part of the dairying in this group is the furnishing of milk for immediate consumption to the numerous large cities. Most of the larger condensed-milk factories are also in this region. Of the remaining milk, about equal portions, as far as may be estimated, are made into butter and cheese.

The second group is made up of the States of Wisconsin, Ohio, Illinois, Indiana, Iowa, and Missouri. They are States of large size, with extensive areas of level or nearly level prairie land, in which the grasses grow, naturally, abundantly and luxuriantly. They are also extremely well adapted to the growth of Indian corn, and for the most part are situated in what is known as the "great central corn belt," and are therefore great beef-producing States, with dairying as a very important though still secondary part of the cattle industry. Of the dairy products of this region butter undoubtedly leads, though large quantities of cheese are made in some localities, notably Wisconsin, and several large cities claim a large amount of milk for immediate consumption.

The last two States of the list, as has been said before, are not distinctively dairy States, but they are of large size, and immense herds of cattle run at large on their extensive grassy plains, which accounts for the large number of cows credited to them. However, as the country becomes better settled, the dairy industry extends further west and southwest, and in all probability they and several other of the Western States may be classed among the dairy States at no very distant day.

PRODUCTION AND EXPORT OF DAIRY PRODUCTS.

In the short time allotted for the preparation of this paper it has been impossible to gather complete recent statistics of the amount of

dairy products produced in and exported from the United States. Through the kindness of Mr. B. F. Van Valkenburgh, assistant dairy commissioner of the State of New York, we have been furnished with a very complete report of the trade in dairy products of the city of New York for the year ending October 31, 1888, prepared by him for the New York State Dairymen's Association. These statistics are as follows:

RECEIPTS OF BUTTER.

Eastern...	454,063 packages, 31,784,410 lbs., at 24.5 cts. per lb..	\$7,787,180.45
Western...	1,269,159 packages, 63,457,950 lbs., at 22.5 cts. per lb..	14,278,038.75
Total	1,723,222 packages, 95,242,360 lbs	22,065,219.20

RECEIPTS OF CHEESE.

Eastern.....	1,797,781 boxes, 98,877,955 lbs., at 10.5 cts. per lb.	\$10,382,185.27
Western.....	80,829 boxes, 3,637,260 lbs., at 8.5 cts. per lb.	309,167.10
Transit for export.....	152,737 boxes, 7,636,850 lbs., at 10 cts. per lb.	763,685.00
Total	2,031,347 boxes, 110,152,065 lbs.....	11,455,037.37

MILK AND CREAM.

5,867,839 cans, 58,678,390 gallons milk.
119,194 cans, 1,191,940 gallons condensed milk.
75,183 cans, 751,830 gallons cream.

Total	6,062,216 cans, 60,622,160 gallons, valued at.....	\$9,652,500.00
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Total value of dairy products handled in New York City during the year ending October 31, 1888.....	\$43,172,756.57
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Total receipts of butter for the year ending October 31, 1888.....	1,733,222 Packages.
Total receipts of butter for the year ending October 31, 1887.....	1,662,436
Increase of receipts of butter in 1888 over 1887.....	70,786
Increase of receipts of cheese in 1888 over 1887.....	79,620

The exports of butter and cheese for the year ending October 31, 1888, were as follows:

7,034,500 pounds butter, valued at.....	\$1,266,210.00
76,046,850 pounds cheese, valued at.....	7,984,919.25

Total value of dairy products exported.....	9,251,129.25
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Value of butter and cheese exported in year ending October 31, 1887.	\$11,000,450.00
Value of butter and cheese exported in year ending October 31, 1888.	9,251,129.25

Decrease in value of dairy products exported.....	1,749,321.75
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The exports of butter from the port of New York and from all ports in the United States for the past six years have been as follows:

<i>From New York.</i>		<i>From all United States ports.</i>	
	Pounds.		Pounds.
1883	18,811,400	1883	22,375,708
1884	15,865,600	1884	21,391,196
1885	14,601,550	1885	19,593,872
1886	11,677,750	1886	14,404,727
1887	9,933,400	1887	12,531,171
1888	7,034,500	1888*.....	8,483,685

* Ten months.

Summary:

Increase in value of butter handled in New York.....	\$706,231.00
Increase in value of milk and cream handled in New York.....	152,600.00
	<hr/>
	858,831.00
Decrease in value of cheese handled in New York.....	734,845.55
	<hr/>
Increase in value of dairy products in 1888 over 1887.....	124,985.45

The amount of oleomargarine handled is so small that there is no record of it kept.

One or two facts of significance are shown by the table.

The first is the constant and rapid decrease in the amount of butter exported, amounting in six years to something more than 62 per cent., while the total amount of butter handled has been increasing. This shows that we are coming to depend less and less upon foreign countries for a market for our dairy products.

The second fact of significance is in relation to the almost complete extinction of the trade in oleomargarine. The trade in this substance at the time that the national law went into effect, in November, 1886, was enormous, and that the business should have been so completely controlled in so short a time is largely due to the efforts of an efficient dairy commission in seeing that the national and State laws were strictly enforced.

While New York City exports about seven-eighths of all the dairy products exported from the United States, it is not to be inferred that seven-eighths of all the dairy products produced in the country are handled in New York City. It has been impossible to get accurate statistics of all the other large dairy markets; but a late estimate of the Commissioner of Agriculture places their value for the entire country, for the year 1888, at \$380,000,000, while the total value of the dairy products handled in the New York market for the same period as given in the table above was only \$43,172,756, or about one-ninth of the whole. However, the proportion between butter, cheese, and milk in the New York market will probably very nearly hold good in the country as a whole, and will give a fair idea of the relative amounts of each produced.

DAIRY CATTLE—KIND, CARE, AND MANAGEMENT.

By far the larger portion of the dairy cows of the United States is what are known as natives or scrubs, that is, they are the descendants of the cattle that were brought over by the people by whom the country was settled, and have since been bred with little or no regard to ancestry and with more or less admixture of the blood of the more improved breeds. This does not indicate that the improved breeds are not appreciated, for in the United States are more Jerseys than on the Island of Jersey, more Holstein-Friesians than Holland, and more Shorthorns than in England, but that the interest in improved stock, which only began within the last fifty or seventy-five years, has not yet been able to diffuse itself through the mass and overcome the indifference of the great majority of breeders, for it is a lamentable fact that far too many, perhaps even a majority of our dairymen, make no attempt to increase the product of their cows by judicious selection and breeding, considering that a cow is a cow no matter how much or how little milk she may be able to give, and regard one bull as good as another if he is able to procreate his

species. The following statistics will show something of the average production of the dairy cows throughout the country.

In the season of 1888, 1,163 creameries and cheese factories in the State of New York were visited by the agents of the State dairy commissioner. These factories received the milk of 407,810 cows (nearly a third of all in the State), and the average product of each cow was 3,034 pounds of milk for the season. This netted the farmer a trifle over 80 cents per cwt., or gave him a return of about \$25 per cow for the season. These factories were open for business about six and one-half months on the average, and but very few of the cows gave any milk before the factory opened in the spring or after it closed in the fall.

The returns furnished by the creamery men to the secretary of the Nebraska Dairymen's Association, and published in the reports of that association for the years 1885, 1886, and 1887, show yields as follows:

For the three seasons an average of nine butter factories, representing 10,760 cows, report an average yearly yield per cow of 76 pounds butter, and two cheese factories representing 660 cows report an average yearly yield per cow of 250 pounds cheese. This is equivalent to a yearly milk yield of between 2,300 and 2,500 pounds per cow.

New York is one of the oldest and best developed of the dairy States, and Nebraska is one of the very newest States in which dairying is at all developed, so that the figures given for each represent extremes, and will give a very fair idea of average results in the country as a whole.

But it would be manifestly unfair to our best dairymen to rest on a statement of mere average returns. Nor does such a statement show the possibilities of our country or our cattle. As showing something of what is done with good care, good management, and good cattle, the following figures are given:

Mr. C. W. Jennings, of Jefferson County, N. Y., in a paper read before the New York State Dairymen's Association in December, 1888, gave the results of a careful enumeration of fifty-four dairies with eight hundred and ninety cows in his county. This report gives the gross returns per cow and the value of the grain ration fed. This last is of great interest as showing the large increase in gross return from a small increase in the grain ration:

Dairies.	Cows.	Gross return per cow.	Grain ration per cow.
<i>Number.</i>	<i>Number.</i>		<i>Value.</i>
10	173	\$22.60	\$3.11
14	234	26.70	3.47
16	234	30.39	4.83
11	145	43.22	6.80
3	54	53.00	11.04

The cows in these herds were a mixture of grades and natives, and fairly represented the average dairy.

The breeders of the various herds of improved cattle obtain results much in advance of this.

The owners of one of the largest and best known herds of Holstein-Friesians in the country make the following statements in regard to the yields from their herds:

37 cows and heifers have made records that average 17,064 pounds of milk in one year.

25 cows and heifers have made records that average 18,034 pounds of milk in one year.

9 cows and heifers have made records that average 20,231 pounds of milk in one year.

In 1881 the entire herd of mature cows averaged 14,165 pounds of milk.

In 1885 the entire herd of mature cows, 20 in number, averaged 15,568 pounds of milk.

In 1886 the entire herd of mature cows averaged 17,166 pounds of milk.

As to butter the records of this same herd are as follows:

100 cows and heifers have made average records of 17 pounds, 1 ounce.

52 cows and heifers have made average records of 20 pounds, 10 ounces.

40 cows and heifers have made average records of 21 pounds, 1 ounce.

31 cows and heifers have made average records of 22 pounds.

22 cows and heifers have made average records of 23 pounds, 1 ounce.

15 cows and heifers have made average records of 24 pounds.

8 three-year old heifers have made average records of 20 pounds, 2 ounces.

23 three-year old heifers have made average records of 17 pounds.

10 two-year old heifers have made average records of 14 pounds, 3 ounces.

38 two-year old heifers have made average records of 12 pounds.

All of the above are for periods of one week; for periods of thirty days 13 cows and heifers have made average records of 91 pounds, 8 ounces.

A very well known herd of Jerseys is kept in Vermont. The herd numbers over 200, and for several years the average butter product has been over 300 pounds of butter per cow, including old cows and young heifers.

The enumeration of herds with similar records might be almost indefinitely extended. The above are given merely as well authenticated instances. For individual records the following might be named: 30,000 pounds of milk in a year; 778 pounds of butter in a year; 106 pounds of butter in a month; 112 pounds of milk in a day; 46, 35, and 28 pounds of butter in a week, etc.

As has already been said, while a great majority of the dairy cattle have had no attention paid to their breeding, yet there are a very large number of purely-bred cattle belonging to the various dairy breeds, and a still larger number of grades of these breeds, that is, cattle that have been produced by crossing the pure-bred bulls on the common cows. An animal is not usually denominated a grade unless it carries at least one-fourth of the improved blood. From that they run up to seven-eighths, fifteen-sixteenths, and even higher.

The improved breeds that may be ranked as dairy breeds in the order of numbers are as follows: Jersey, Holstein-Friesian, Short-horn, Ayrshire, Guernsey, Devon, and Red Polled. There are also a small number of representatives of the Brown Swiss, Dutch Belted, and perhaps one or two other breeds.

The Jersey is the most numerous of the dairy breeds. The cow numbers in the herd-book now exceed 50,000, and there are probably in the neighborhood of 40,000 registered cows and heifers in the country. The number of grades is also very large, and they are among the most useful of the dairy cows of the country. However much her position may be assailed by the partisans of other breeds, there is no doubt that the Jersey stands at the head of the butter-producing breeds in this country; but she is mainly valuable as a butter-producer, and is of course most highly esteemed where butter-making is a prime object. On account of her graceful form, beautiful coloring, and extreme docility, the Jersey is a favorite with the wealthy owners of large country places, who engage in agriculture as a pastime, and who care as much for the esthetic beauty as the practical utility of their live-stock.

Some urge against the Jersey that she is lacking in hardiness and constitutional vigor, but she is profitably and successfully kept and reared in the coldest and most rigorous parts of the country, and even in the neighboring Dominion of Canada, where the winters are much longer and more severe than they are in the United States. This much seems to be true, however, that the Jersey, while not lacking in hardiness or constitutional vigor, appears to be peculiarly sensitive and responsive to both good treatment and neglect. For some years after they were first imported, and up to six or eight years ago, thoroughbred registered Jerseys commanded a very high price. Since then the price has fallen, and now good serviceable recorded animals can be bought at from \$100 to \$200 each.

Next in point of numbers to the Jersey comes the Holstein-Friesian. The name Holstein as applied to these cattle is a complete misnomer, but became attached to them when they were first imported and has since stuck to them. They are the large piebald black and white cattle that are imported from the Dutch provinces of North Holland and West Friesland. The first small importation of these cattle was made about the year 1860, and up to 1870 there were but few in the country; since then they have rapidly increased and there are now probably between 15,000 and 20,000 registered cows and heifers in the country. These cattle are pre-eminently large milk producers and consequently are favorites in the cheese-making districts and in those localities devoted to the production of milk for immediate consumption. The Holstein is an especial favorite with the latter class because, aside from the large quantity of milk produced, the well-balanced character of its constituents renders it peculiarly satisfactory to the consumer.

The Holstein is a voracious feeder and gives her best returns only where the pastures are rich and luxuriant, or where an intelligent and liberal feeder is willing to supply nutritious food in abundance. It is often urged against the Holstein that her milk is too poor in butter fat, but these cases can almost always be traced to the result of insufficient or injudicious feeding. Holsteins are large, vigorous, and hardy and almost always produce large and vigorous calves. In price recorded animals range about with the Jerseys.

I have ranked the Shorthorn third as a dairy breed. Very many dairymen would probably not give them any rank at all as dairy animals. But while the Shorthorn is the most numerous and probably the best of the beef breeds, a very large proportion of the butter and cheese of the country is made from the milk of Shorthorn and grade Shorthorn cows. So, while the Shorthorn is the most nu-

merous of all the breeds and undoubtedly first of the beef breeds, I rank her third of the dairy breeds. Throughout all the great central dairy region (the second group of States in the table), Shorthorns and their grades probably outnumber all other breeds and their grades as five to one.

The Shorthorn, in her English home, was primarily a dairy animal. Afterward more attention was paid to beef production and the milking propensity was pretty well bred out of many of the families. As we find them in the United States to-day the better class of dairy Shorthorns give a fair amount of milk of good quality. They are large, hardy, and docile, and the numerous grades, when bred to either Holstein or Jersey bulls, produce a very excellent and extremely useful type of dairy cows.

The Ayrshire is a small, hardy, active cow, chiefly noted as a milk producer. Up to ten or twelve years ago she was a great favorite in the cheese-producing districts of New York and New England, but since then she has been largely supplanted in these districts by the Holstein. Still, she will thrive and give a fair return on pastures and under treatment which would render her Dutch competitor totally unprofitable, and on account of her activity and small size she is a useful animal in the mountainous and more unfertile districts.

Although the Ayrshire has an especially well-formed udder she has been unpopular with many on account of the extremely small size of her teats and also on account of her nervous and somewhat irritable disposition. The more progressive of the Ayrshire breeders are now paying more attention to docility, size, and large teats, and good results can already be seen in several herds.

The Guernsey, like her near relative, the Jersey, is a butter producer, and so like her in nearly all respects that what was said of one will very nearly apply to the other. The Guernsey is slightly the larger and by many is considered to be hardier, and yields a more highly colored butter. For some unaccountable reason they have never been as popular as the Jerseys, and are only found in small numbers.

The sprightly, tidy, ruby-colored Devon is a favorite of the farmer who lives in hilly or mountainous districts. In return for scanty fare she will yield a small amount of rich milk and a small carcass of beef of excellent quality. The steers make the very best of working oxen, being intelligent, active, and docile.

The other breeds have not as yet been imported in sufficient numbers to definitely establish their claims on popular favor.

Throughout the dairy regions of the United States the pastures can not be turned upon before the first of May, and in many portions not until the middle or after. It is a general custom among dairymen to have the calves dropped during April. The cows then go upon grass in the flush of their flow of milk. Ordinarily they receive no feed except the grass that they crop, and during all the early part of the season will do very well on this alone; but in the latter part of the summer they begin to fail, and give less and less until they go dry in November or early in December. A few of the better class of farmers will supplement their pastures in the fall with fodder corn. Very few feed any grain rations to their cows during the summer. Under this system the cows are dry from four to five months. This is the ordinary practice of the ordinary farmer, especially in the cheese-making districts and the districts where the butter is made on the farm in private dairies. The cheese factories ordinarily only run

from six to seven months. Under this system the cows only receive a small amount of grain, and that is mainly corn meal. Almost all variations from this system are in the lines of improvement and will be treated somewhat in detail.

The dairymen who furnish milk for immediate consumption aim to make an equal quantity, as near as possible, through the whole year, and for this purpose breed their cows so that calves are dropped in every month. The cows are well fed from the time that they calve, and so do not go dry more than a month or six weeks. Cows that are inclined to go dry too soon, or that do not give a satisfactory amount of milk, are quickly fattened and sent to the butcher. These dairymen are, of course, found in the largest numbers near the cities and large towns, where the land is high-priced, and do not as a rule raise their own cows, but depend on such as they can buy. Most dairymen of this class are intelligent and liberal feeders. They aim to keep as many cows as possible on their farms, and so raise but very little grain; but they do raise a large portion of rough fodder. Indian corn is largely raised for fodder, and its growth and preservation have undergone a marked revolution within the past ten years. Formerly it was the almost universal custom to sow it broadcast so thickly that nothing but leaves and stalks were produced. In this way it was possible to grow a large amount of fodder per acre; but it was difficult to handle, difficult to cure, and unsatisfactory when fed. The first step toward improvement was the introduction of the silo, now about twelve years ago; but the principles governing the preservation of green corn in silos were not well understood, and the first ensilage did not give generally satisfactory results. It was supposed that it was necessary to weight the silo heavily, and this made necessary heavy side-walls and needless expense. It was also recommended to cut the corn at or soon after blossoming, when it was still green and immature, and hurry it from the field to the silo as rapidly as possible, and as the corn was still grown so thickly that no grain was produced it is no wonder that the ensilage was sour and unsatisfactory. Within the last few years there has been a marked change, and the practice of the most successful farmers is about as follows: The walls of the silo are made only sufficiently strong to sustain the weight of material that they are to hold. They are often made of wood. Great care is taken that they shall be as nearly as possible air-tight. This is secured by double boarding on each side of the joists, with building-paper between the boards. The corn is sown thinly so that there may be a good development of grain, and it is allowed to stand until the grain is mature. It is then cut, allowed to wilt in the field, and taken to the silo. The silo is filled slowly. After it is filled to the depth of 3 or 4 feet, filling is suspended until the mass already put in has reached a temperature of 120° F., when another portion is added and allowed to heat up, and so on until the filling is completed. By filling slowly in this way and allowing fermentation to proceed to a certain degree, carbonic acid is formed, and this being heavier than air drives it out and effectually excludes it from the silo. When the silo is full it is covered tightly with building-paper and matched boards, or in some cases even with straw, so that the air may be kept out, and is not weighted at all. In this way it has been found possible to preserve corn with but a minimum development of acid, and to secure a valuable, palatable, and nutritious food.

But to come back to our milk dairy farmers. While they raise but little grain, and that chiefly Indian corn, they feed grain heavily, especially in winter. From their proximity to the cities, brewer's grains are a cheap food, and they have a very marked influence on the flow of milk. They are consequently fed fresh, dried, or preserved in silos in as large quantities as is considered safe; but from their bad effect on the quality of the milk and the health of the cows, when fed to excess, they have always to be used with caution. Large quantities of wheat bran, linseed-oil meal, and cotton-seed-oil meal are also used. Roots are not used to any great extent either by the milk farmers or by any other class of dairymen in the United States. The great objection to them is the cost of raising, and ensilage, as furnishing a succulent food in the winter time, very nearly fills their place.

A large number of the butter dairymen are beginning to learn that the winter is the most profitable season in which to make butter. In making winter butter the cows are bred to drop their calves in September and October. The cows are well fed during the fall and go into winter quarters with a full flow of milk. With care and good feed the flow of milk is kept up during the winter and the cows go on pasture in the spring in good condition, and will give nearly as much milk during all the early part of the season as a cow that has lately calved. They go dry during July and August and calve again in September, and are ready for another season's work. Some of the advantages of this system are:

The cows are dry at the period of the year when flies and other insects are most troublesome, when it is most difficult to make butter of a good quality, and when the butter brings the lowest price in the market.

Numerous experiments have shown that a cow calving in September or October will give more milk and make more butter in the course of a year than will one calving in April or May.

The calves having an abundance of skim milk during the winter are ready when spring comes to make a vigorous growth, and will attain a better development at a year old than will calves born in the spring.

The labor is more evenly distributed through the year, and last but not least a large part of the butter product of the year is made in the months when fresh butter is scarce and commands a high price.

But winter dairying requires something more than ordinary methods in order to insure success. Some of the more important requisites are given below:

Intelligent and liberal feeding. Not only must the cows be well fed but properly fed. It is easier to make a cow grow fat in the winter than it is to make her give milk. Winter dairymen have found that it is important that their cows must have plenty of nitrogenous food.

The animals must be comfortably housed, not only at night but in all but the very pleasantest weather. Many of the best of the winter dairymen are finding it profitable to artificially warm the water for their cows.

Watchfulness and painstaking care on the part of the owner. A man will not make a success of dairying in the winter unless he is willing to sacrifice his own comfort, when occasion demands, to the welfare of his cattle.

The feed and management during the winter does not differ greatly from that given by those who make milk for market. A large num-

ber of the winter-butter dairymen are in the great central dairy region and raise large quantities of corn, and being close to the large flouring mills of the West, depend largely upon wheat bran and corn meal for their grain ration. These, with corn fodder, ensilage, and clover and timothy hay, are the great staple fodders, and it would indeed be hard to find better foundations for economical rations for butter production.

It is in attention to what are often called minor matters of detail that our better dairymen obtain much of their success. Thus, all good dairymen are extremely particular that the water supplied to their cows shall be convenient, abundant, and pure, and are careful that it shall be supplied from either wells, springs, or running streams.

The importance of an abundant and regular supply of salt is not understood by so many; but a well-known and painstaking professor in one of the best of our agricultural colleges has shown as the result of an experiment that when the cows are not salted regularly there is a loss of $14\frac{1}{2}$ per cent. in the quantity of the milk; that the milk when set at 60° F. becomes sour twenty-four hours sooner, and that the cream takes one-third longer time in churning.

The bad effects of excitement on the cow so far as the milk and butter product is concerned, it is to be feared are well understood by many more dairymen than are careful to see that their cows are kept as free as possible from all disturbing influences. However, no self-respecting dairyman will allow his cows to be driven by dogs, or will allow cursing and blows in the stable and yards.

Within the last year or two the practice of cutting off the horns, not only of cows but of all classes of cattle, has begun to be extensively practiced. The custom has been a fruitful source of discussion in meetings of stock-breeders and dairymen and in the agricultural press, and may still be considered an open question. A speaker in a late meeting of cattlemen has so well summed up the arguments on both sides that they are here given entire:

On the affirmative side we are told by professional dehorner "that it will surely save (1), one-fourth the hay in feeding store animals; (2), 10 per cent. of the corn in fattening; (3), one-half the shed-room; (4), all loss in shipping cattle; (5), most cases of abortion; (6), hundreds of human lives; (7), thousands of brute lives; (8), the blue streak of profanity from ocean to ocean."

The main objections raised are:

(1) "It is painful and cruel, and disfigures the animal."

(2) "It does no permanent good. A dehorned cow will, when her head gets well, be the same old cow, but she is now armed with a battering-ram instead of spears. It is merely a change of weapons."

(3) "It changes the disposition; it prevents bulls from goring, but you have got a homely, deformed, meek, listless, mild-eyed bull, with a disposition that would disgrace a two-year-old heifer."

(4) "Dehorning decreases the flow of milk, and particularly the production of butter fat, and impairs the 'butter potency' of the bull."

(5) "The horn contains a marrow and a red, gluey substance which feed and nourish the spine, and the spine helps feed the brain, and the branching nerves feed the heart, liver, and kidneys. In dehorning we take away the life-giving power and cut off the nutriment which helps supply the most important part of the system. It also imparts a weakness to the offspring, causing a weak spine and deformity."

The operation is performed as follows: The animal is confined by throwing or secured in a chute and the horns are quickly sawed off close to the skull with a sharp, stiff-backed saw. Whatever the arguments, there is no question that the operation can be easily,

quickly, and successfully performed, and with a small amount of pain to the animal.

One reason for the large number of inferior dairy cows is undoubtedly the lack of attention paid to the rearing of dairy stock. Very many dairymen do not pretend to raise their own cows, but depend upon purchases to keep up their herds. The result of this is that the cows are born and brought up on the rough, hilly, back farms, by men who are not enterprising enough to make dairymen. Beside the lack of attention to breeding, these animals are allowed to subsist as best they can on coarse fodder until two years of age, and when, having brought forth a calf, they are sold as milch cows to some dairyman, it is no wonder that 3,000 pounds is about the measure of their yearly capacity for milk.

The better class of dairymen raise their own cows, and are particular as to their care and treatment from calfhood up. The young calf is taken from the mother when about twenty-four hours old. Many do not allow the calf to draw the milk from the cow but once, and some do not allow the calf to suck at all. After the calf is taken from the cow it is immediately taught to drink, and is fed new milk from the cow for from four to six weeks. After that it is fed sweet skimmed milk until it is from four to six months old. As soon as it shows any inclination for dry food, which it will do when from three to four weeks old, it is supplied with whole oats or wheat bran in which a very little linseed-oil meal has been mixed, and a little bright clover hay is placed where the calf may nibble at it. In this way it is kept growing during its first summer. The feed for the first winter is largely clover hay, if it is at hand, or if not, oat straw or corn fodder, supplemented with a grain ration which is rich in nitrogenous matters, as oats, barley, wheat bran, linseed or cotton-seed-oil meal. During the second summer the young heifers run on pasture without grain, and in the second winter if good coarse fodder is at hand it is not usual to feed grain.

The young heifer is expected to drop her first calf when two years old, and regularly each year after that. Some of the best dairymen vary this practice by having the first calf dropped when the heifer is two and a half years old and the second when she is four years old, thus giving a long period of milking between the first and second calf. They claim that by a long period of milking after the first calf the "milking habit" is more firmly established and a better dairy animal results.

BUTTER MAKING.

Below is given the report of the butter committee of one of the "butter conferences" held by the New York State Dairymen's Association during the past year. It is given as the practice recommended by a committee of the best butter makers of the State.

It is important that the cows should be adapted to the purpose. The feed should contain the proper elements for making butter. As proper feed we recommend a mixture of bran, corn, oats, mill feed, and peas, with a small amount of linseed and cotton-seed meal. This feed should be mixed in proper proportions. The cows should be fed and milked with regularity. The water should be pure, the stables well ventilated, the cows kept clean, and the most careful and painstaking care had in all places for cleanliness. To leave the milk-pails unwashed over night, even though no dirt is added, and they may be as clean apparently as they were when used the night before, is a dangerous mistake. During the night incipient putrefaction may take place in the milk left over, and these germs will affect the milk put in them, and its produce. There is something more than cleanliness required in the dairy—

there must be the purifying effects of boiling water. The utensils should, therefore, always be scalded immediately after being used and kept perfectly clean and sweet. The cows should be milked regularly at the same hour each day and as nearly as possible at intervals of twelve hours, and always, if possible, by the same person. As soon as the milk is drawn it should be set for the cream. It should always be set in deep cans in cold water. The importance of immediate cooling for the milk is not enough appreciated, and the sooner it is cooled, and well ventilated at the same time, the better will it be for any use. For butter excessive cooling is not recommended. To cool the milk down to 45° F. is about right. Cream will rise sooner with a lower temperature, but it is doubtful if the product is so good as when the cream is raised at a temperature of about 45° F., or a little less. On no account should the temperature go below 40° F. The cream from milk cooled down to these low temperatures is thin, green, or immature, and must be given time to ripen or come to perfection. The cream should be raised within twenty-four hours, after which it should be kept at a temperature of 45° F. until the ripening process begins. The surroundings must be pure, free from taints, and the cream stirred frequently that it may become well oxidized. This is a part, and an important part, of the ripening process, during which the full properties of perfect cream are developed. By "ripening" cream is meant a full aeration or oxidizing, which produces the best flavor in the resulting butter. To bring it to the highest degree of perfection in this respect it should be stirred occasionally and kept in a cool and even atmosphere (say 45° F. as a standard) for at least twenty-four hours after the last batch of cream has been put in. This is done to insure uniformity of the cream in its ripeness—to give time for it all to ripen. At the end of the twenty-four hours it may be warmed up to about 60° F., when acidity will develop, and it is fit or in the best condition to churn. This is a rule, or a good law. Circumstances may modify the conditions or make radical changes, such as cool weather, hot, murky weather, thunder storms, food, pure water, etc., but the nearer the rule can be observed the better will be the butter. Sourness is not ripeness. Sourness does not get the most or the best butter if it is carried beyond the perfect point, which is simply "acid." A continuation of acidity will lessen the amount of butter and make a miserable quality, and if it is left to do its full work it will eat up all the butter fats, and there will be no butter. Cream of different degrees of acidity will not churn evenly; hence there must be a time when to stop adding fresh cream, and this time is designated "the beginning of the ripening process." After this ripening should go on for twenty-four hours, and it is slower and more complete in a cool temperature than it is in a warm one, where the cream speedily gets too sour and must be churned or lose in flavor and quantity of butter.

When the cream is completely and properly ripened, churn at a temperature varying from 62° to 68° F., according to the season and the surrounding temperature. When the butter has become about the size of kernels of wheat draw off the butter-milk and add cold water. Agitate the churn gently, then draw off the water, and repeat this process until the water runs clear. Take the butter out carefully and weigh it. Place it on the worker and salt it; one ounce to the pound. Work enough to thoroughly incorporate the salt and pack the butter immediately.

Butter is made both on the farm, in private dairies, and in creameries or butter factories. The creamery system, as it is called, was first introduced about fifteen years ago, and has since spread rapidly. Its chief advantages are that a better and more uniform quality of butter can be made, and the farm is relieved of a large amount of drudgery that usually fell upon the women.

Creameries are run either upon the "gathered-cream" or "whole-milk" plans. The former are by far the more numerous. Under this system wagons are sent by the creamery to the houses of the patrons, and the cream, which is always raised in deep cans set in cold water, is skimmed by the driver. The cream of each patron is either weighed or measured and a small sample taken to be tested. Formerly a certain number of cubic inches of cream were taken for a pound of butter and the patron paid accordingly, but it was found that cream varied so greatly in its percentage of butter fat that while an average could be so closely approximated that the creamery would suffer no loss, great injustice would be done individual patrons. To correct this injustice several systems of testing were devised. They all depended upon the principle of quickly separating the fat of the

milk or cream into oil and measuring the amount of oil obtained from a given amount of milk. In nearly all the fat is first separated by churning and then converted to oil by heating in warm water, though in a method lately devised by Professor Short, of the Wisconsin Agricultural Experiment Station, the fat is separated by boiling the cream first with strong alkali and then with acid. There are several of these methods that give results so nearly accurate that nearly all the creameries have adopted some one of them, and pay for their cream on the basis of its richness in butter fat, as shown by the "test."

The cream having been brought to the creamery, all collected in one day, is poured together in a large vat and ripened, after which it is churned and worked by power, all the details being conducted with the greatest attention to cleanliness, temperature, and all other conditions that may affect the quality of the butter.

The "whole-milk" creameries only differ from the "gathered-cream" in that the milk is brought to the creamery by the patron and the cream separated there, either by deep setting in cold water, or by the centrifugal. The latter is the more common practice in these creameries. These creameries have an advantage over the "gathered-cream" system in being able to secure more uniform and better conditions before the cream is separated, but the latter have the advantage in that the skimmed milk is left on the farm, where it is an important article of food for swine and young stock.

Creameries are either co-operative or proprietary. In the former case the patrons own the plant, hire the butter made, attend to the marketing, and divide the net proceeds among themselves in proportion to the amount of cream furnished. In the latter case the creamery is the property of an individual or stock company, and the cream is bought outright from the patrons. Both systems are in successful operation, but there are probably more proprietary than co-operative creameries.

It is perfectly possible to make the best of butter in private dairies, and the very choicest butter made in the country is so made; but there are only a very few such dairies. Most of the private dairies are small, and the churnings are small; moreover, since it is impossible to control the conditions, each churning makes a different quality of butter, and each farmer makes a different quality of butter, and when the whole is thrown on the market brings a low price, fully as much from the diversity of its character as from lack of quality. Another reason for the low price of dairy butter comes from the fact that a large portion of it reaches the market through the medium of the country storekeeper, and while it may be of good, or at least fair, quality when it leaves the farm, it suffers so from the rank odors of the various "groceries" that it comes in contact with that it is sadly degenerated long before it reaches the consumer.

There is a considerable quantity of butter of a fair quality made in private dairies, especially in localities that are remote from markets and still specially adapted to dairying. In these places it is still the custom to set the milk in shallow pans in the open air at a temperature as nearly 60° F. as it is possible to obtain. It is also customary to pack the butter and sell the whole product of the dairy for the season at one time in the fall. These regions are the source of the best private dairy butter in the market; but even here the tendency is toward the adoption of the creamery system.

The demand of the American market is for fresh butter. This

has stimulated both the growth of the creamery system and winter dairying. The creameries making large quantities of butter can and do ship butter in quantity as fast as made, so that it reaches the consumer as fresh as possible. For this purpose refrigerator cars constructed specially for the purpose are almost exclusively used, and in them butter can be shipped long distances in good condition. The introduction of refrigerator cars has extended the dairy, and especially the butter, industry over a large extent of territory that without them could not profitably engage in these industries.

CHEESE MAKING.

The growth of the cheese industry in the United States dates from the introduction of the cheese factory, a little less than thirty years ago. Up to this time all cheese had been made in private dairies, and what has been said in regard to the quality of private-dairy butter was true, in an even greater degree, of the private-dairy cheese. At the present time practically all of the cheese is made in cheese factories, and a very large proportion of them are run on the co-operative plan.

So long as a full-cream cheese was made our cheese enjoyed an excellent reputation not only at home but abroad, but the practice of skimming has so injured the reputation of our cheese that, seeing their folly, our cheese makers are now urging a return to the making of only full-cream cheese.

By far the larger part of the cheese is of the variety known as the American Cheddar. It is a cylindrical, flat cheese, of from 40 to 60 pounds weight, about 18 inches in diameter and 6 inches thick. There are also a considerable number of a variety known as "Young Americas" made. These are made of the same general shape, but of such size that five can be packed in the same sized box as one of the ordinary kind. The fancy varieties of cheese are not made to any great extent, but Limburger, Stilton, Edam, Pineapple, and Neuchâtel, Swiss, or cream cheese, are all made in a few factories in isolated localities. Below is given the method taught by the cheese instructors of the New York State dairy commission. It is called the "modified Cheddar process," and is essentially the practice of the best cheese makers throughout the country:

The milk is placed in the vat and heated from 82° to 84° F., in the warm weather of the summer, and to 86° F., in the cool weather of the fall. If color is to be used it should be stirred in thoroughly before adding the rennet.

Sufficient rennet is used to coagulate the milk in from twenty to twenty-five minutes and bring the curd into a condition fit to cut in from fifty minutes to one hour. The rennet extract, or powder, on account of uniformity of strength, is considered safest to use, and there is not the liability to taints that there is when makers prepare their own rennet in tubs, jars, etc. The curd is then cut lengthwise of the vat with a horizontal knife. The cutting is begun as soon as the curd will cleave clean from the sides of the vat, or break clean before the finger, or cut without breaking before the knife. It is then cut lengthwise and crosswise with a perpendicular knife. The cutting should all be done as soon as possible after beginning, as it is claimed that if the curd is in proper condition, or, in technical language, if it is just hard enough to begin on, the quicker it is cut the less waste there will be. If the curd is too hard the knife will break

off fine particles which are lost in the whey. When the cutting is completed the curd is gently agitated for about fifteen minutes.

The heat is then slowly applied up to 90° F., then more rapidly until the highest point is reached, from 98° to 102° F. In order to preserve the most fat the lowest temperature which will cause the complete expulsion of the surplus whey should be used, though with some milk it will be necessary to heat up to 102° F. Great care should be taken during the heating process to stir so thoroughly that not any part of the curd will become overheated by resting too long upon the hot tin; because this would melt the fat and partially destroy the activity of the rennet in that portion of the curd. Keep the curd agitated till it reaches the stage of contraction at which it will not pack.

The vat is then covered with a cloth in order to retain an equable heat through all parts of the mass, stirring under the cover occasionally to keep the curd loose. The curd is allowed to remain in this condition until sufficient acid is developed to show a quarter of an inch of fine thread by the hot-iron test.

The whey is then all drawn off and the curd packed about equally on the two sides of the vat, leaving a clear space in the center, for the purpose of draining. After a few minutes, and for the same purpose, the layers of curd are cut lengthwise through their centers and again crosswise into strips or blocks about 12 inches long; the center strips are turned bottom side up and placed upon the outside strips; keep well covered with a cloth. In ten minutes or so the two piles are turned over and placed in the center of the vat, one on the top of the other, forming one row of four layers.

Up to this point the chief object of the process has been to separate the whey from the curd, but from this point out the process is distinctly one of digestion or "assimilation."

The pile is left lying in this way for a time, and as it flattens out it is again cut and doubled up and kept as close as possible in order to retain the temperature.

It is important that during these manipulations the temperature be kept up to about 98° F., as this is the most favorable for the maturing of the curd, and to have it assume that flaky appearance and velvety feeling which it must do in order to be a perfect curd.

If, from any cause (as tainted milk, etc.), there is a development of gas at this stage, the packing must be continued until the gas cells become flattened and the curd appears solid and shows about the same texture as a perfect curd.

The production of lactic-acid fermentation is important here to overcome putrefactive fermentation, which is very liable to develop, especially in hot weather, and which is very destructive to the flavor, quality, and firmness of the cheese.

When the curd has reached the proper stage of digestion, it can be torn into strings and "ribbons" the whole length of the piece, like the inner bark of an elm tree, and the torn surface has a fibrillated appearance like the cooked flesh on a chicken's breast. The curd is now cut up into strips, spread out in the bottom of the vat, allowed to cool down to from 88° to 85° F., and then ground. The salt is applied as the curd passes through the mill. The salt is then stirred in and the curd is reground and put to press. The pressure must be slight and applied gradually till the whey is pressed out and the rind is formed. If left in the press from twelve to eighteen

hours, it will retain its form better and be more solid than if pressed in less time.

The above method is based upon the use of *pure* milk. To make a close, meaty cheese from floating curds it is necessary to modify the process. In this case we use the same amount of rennet, cut a little finer, and stir from ten to fifteen minutes without steam. Apply the steam slowly at first, taking plenty of time for the temperature to rise to the highest point needed (100° F.). The curd must not be allowed to pack on the bottom of the vat. Use every means possible to drive out the surplus whey.

When the acid shows one-half inch on the hot iron draw off all the whey, pack the curd in as small a space as possible, cover the vat so as to retain the heat, cut the curd into strips often, and repack. When the gas has fully developed, run the curd through the mill, repack it and keep it covered so as to retain the heat, letting in dry steam under the cover to warm the curd if necessary. When the gas holes become flattened and the curd appears close and solid and shows about the same texture as one made from good milk, cut it up into strips and spread it out thin over the vat. Then allow it to cool to about 85° F., grind, salt the same as for good curd and put it to press. Allow it to remain in press as long as your time will permit, at least eighteen hours.

Prof. J. W. Robertson, lecturer on dairy husbandry in Cornell University, and a recognized dairy expert, has issued a series of more than a hundred "Hints to Cheese Makers." In the main they cover the process given above, but some of them supplement and explain points of that process and are given below:

Over-ripe or acid milk may, with advantage, be set as high as 96° F., according to the degree of its ripeness.

In the use of coloring the annatto extract should be diluted to the extent of 1 gallon of water to every vatful of milk, and then thoroughly stirred in.

Pure rennet extract or powder of known strength is indispensable. The quantity used should be regulated according to the condition of the milk.

Rennet should be diluted to the volume of at least 1 gallon of liquid for every vat before being added to the milk. It should be thoroughly mixed by vigorous stirring, otherwise coagulation will be very imperfect.

To perfectly coagulate the milk from fresh-calved cows, more rennet is required than later in their milking season.

The more rennet there is used the more moisture will there be retained in the cheese under similar conditions of making.

The more moisture there is retained in the cheese the more quickly will it cure under equal condition of temperature and atmosphere.

Pains should be taken to make the curd particles so dry before the development of acid is perceptible, that after being pressed in the hand and released they fall apart when slightly disturbed.

The presence of too much moisture in the curd while the acid is developing is the cause of tenderness of body and pastiness in cheese.

If the temperature be allowed to fall below 92° F., the development of acid is retarded and excessive moisture is retained in the curd during its development.

The conditions of the curd, as to when ready for cutting and salting, are best ascertained by the use of the senses. The usual order of reliability for that purpose is by touch, smell, taste, and appearance. The proper degree of change has taken place when the curd feels mellow, velvety, and greasy, smells like new-made butter from sour cream, tastes aromatic rather than sour, and shows a texture passing from the flaky or leafy into the stringy and fibrous.

One pound and three-quarters of pure salt per 1,000 pounds of milk is a maximum quantity for April and early May cheese. From 2 pounds to 2½ pounds is the range for summer use on fairly dried curds, and from 3 pounds to 3½ pounds during October and November.

Where extra rennet has been used, or where the curd is sloppy, a corresponding increase of salt should be applied.

One important action of salt is to dry the curd and cheese, and thus retard the curing.

All cheese should be turned in the hoops in the morning to give finish to the shape and body.

No cheese should be taken to the curing-room till the shape is true and the edges well made.

The cheese should be turned on the shelves once a day till at least three weeks old.

The curing is effected by fermentation, while heat up to 70° F. makes a favorable condition, and cold under 60° F. an unfavorable condition for its operation.

A temperature of from 70° to 75° F. should be maintained for curing spring cheese, while 65° to 70° F. is the best range of temperature for the curing of summer and fall cheese.

DAIRYMEN'S ASSOCIATION AND DAIRY EDUCATION.

The education of the farmer and dairyman in the better dairy practices has been very largely brought about by the influence of the dairymen's associations. The pioneer and parent of these was the American Dairymen's Association. It was established in 1864, soon after associated cheese making had been found to be successful. At the first meeting there were representatives from sixty-nine cheese factories present. At the next meeting the attendance was largely increased, and for several years there was a steady growth, the interest and attendance finally becoming truly national in character. Some of the best of our dairy literature is found in the published reports and proceedings of this association. As offsprings of the American Dairymen's Association various State associations sprang up, and being more local in character gradually supplanted the parent association, and it was finally disbanded in 1882. The State associations continue to prosecute the work with vigor, and in their reports and conventions are building up a literature not second to that of the parent society. There are now flourishing organizations in the States of New Hampshire, Vermont, New York, Pennsylvania, Michigan, Illinois, Wisconsin, Iowa, and Nebraska.

There are no schools especially established to give instruction or practice in the various operations of dairy industry, though a movement is now on foot in New York looking to the establishment of such schools. Several of the State agricultural colleges founded on the land-grant act of 1862 give special attention to this important branch of agricultural industry. This is especially true of Cornell University, at Ithaca, N. Y., the University of Wisconsin, at Madison, Wis., and the State Agricultural College at Starkville, Miss.

Last but not least of the means of dairy instruction is the system of farmers' institutes now established in many of the States. Under this system trained lecturers are sent at State expense to attend meetings of the farmers and instruct them orally and by illustration in all the practices of improved agriculture.

These meetings have been the means in the last few years of disseminating many new ideas and practices with much resultant good to the farmer and dairymen; and these farmers' institutes have been best attended, and have done the most good in the States where dairying is a leading industry.

CATTLE AND SWINE REARING AND FEEDING IN THE UNITED STATES.

By Prof. GEORGE E. MORROW.

For many years rearing and feeding cattle and swine have been important parts of the work of most of the farmers of the United States. There has been a good home and fair foreign demand for these animals or their products. In no other country is the consumption of meats so great in proportion to population, and this chiefly of beef and pork rather than of mutton. Milk and butter have also long been used freely, and cheese to a less notable degree.

As what are now the central Western States were occupied, farmers found in the fertile soils and climate, favorable for the production of forage grasses and cereals, more especially maize, strong inducements to give large attention to cattle rearing. In a peculiar sense was this true of the settlers on or near the vast prairies, covered with a luxuriant coat of fairly nutritious grasses, and with a soil not only possessing great stores of readily available plant food, but capable of being brought into cultivation with a minimum of labor and cost. More recently, still more extended areas of lands in the further West, most of it unsuitable except for grazing purposes, were stocked, within a decade, with millions of cattle.

The obvious superior fitness of animals and animal products over grains, for transportation to distant markets, has had much influence in more and more widely extending stock farming in most parts of the country. While this branch of agriculture, taken as a whole or considered with reference to either of its divisions—the production of cattle, horses, swine, or sheep—has had alternations of great prosperity and of marked depression, it is clearly true that the average profits have been fairly satisfactory, and the business has received the attention of many of the most intelligent and progressive farmers of the country.

The number of domestic animals in the country or the number and distribution of those of any one class can not be given with accuracy. The estimates of the statistician of the national Department of Agriculture include only the numbers to be found on the farms and ranches of the country, making no estimates of large numbers kept in cities and villages.

There are, probably, at the opening of the year 1889, about 50,000,000 cattle on the farms and ranches of the country. The official estimates give the number on January 1, 1888, as 49,234,777, classified as, milch cows, 14,856,414; oxen and all other cattle, 34,378,363. This showed a total increase of 1,200,944 in the year 1887, as compared with an increase of 2,523,203 in 1886. It is believed the increase in numbers in 1886 was very slight.

It is exceptional not to find cattle on the average farm in any part of the country, and while there are striking differences in the extent to which cattle rearing is pursued in different parts of the country, it is difficult to satisfactorily name those portions most properly to be called cattle-rearing sections. A comparison of numbers by States is misleading, owing to the great difference in the size of the States and the difference in the average value of the animals. Thus, Texas

has about one-seventh of all the cattle in the country, but the number in proportion to total land area is slightly less than in the State of Rhode Island, with an insignificant total of 36,037 head of cattle; and the value of the cattle of Iowa is almost as great as the value of those of Texas, although the number is not half so great.

In general it may be said the highest average value of cattle is in the northern Atlantic States, but, excepting New York and Pennsylvania, none of these have large numbers and all of them import considerable numbers of beef-cattle or meats. The more northern States have the largest number and most valuable dairy cows. The South Atlantic and Gulf States have comparatively small numbers of cattle, of inferior quality.

The regions from which cattle for dressed beef are largely exported to other States or to other countries are two: A group of seven States in the central West, Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, and Nebraska, these also being known as the chief corn-export States; and a group of two States and three Territories in the further West, Texas, Colorado, New Mexico, Montana, and Wyoming. These two groups have more than half of all the cattle in the country (about two-thirds of all, aside from the milch cows). It is to be kept in mind that in the second group only a small percentage of the cows is classed as milch cows, as they are not used for dairy purposes, being suckled by their calves.

This classification is somewhat arbitrary and does injustice to some States noteworthy for number or excellence of cattle, as New York, with, approximately, 2,400,000 head, of which over 1,500,000 are milch cows; Pennsylvania with about 1,800,000 head.

The accompanying table, from the Report of the Commissioner of Agriculture, gives estimated number and value of the cattle in each State and Territory, January 1, 1888:

Table showing the estimated number and value of cattle on farms in the United States January 1, 1888.

[From the report of the statistician, United States Department of Agriculture.]

States and Territories.	Milch cows.		Oxen and other cattle.	
	Number.	Value.	Number.	Value.
Maine	167,507	\$4,857,703	185,160	\$5,093,108
New Hampshire	99,021	3,020,141	141,670	4,241,119
Vermont	225,552	6,473,342	180,362	5,059,093
Massachusetts	180,319	6,161,500	105,023	2,990,105
Rhode Island	22,883	818,067	13,154	424,403
Connecticut	127,153	4,286,328	109,926	3,434,104
New York	1,540,053	46,971,617	851,128	27,164,603
New Jersey	178,114	6,397,855	68,541	2,217,467
Pennsylvania	929,371	26,580,011	867,059	22,620,106
Delaware	23,683	860,490	27,137	759,885
Maryland	135,021	3,814,843	138,182	3,340,798
Virginia	257,793	5,542,550	423,761	7,360,725
North Carolina	243,758	3,900,128	419,883	4,607,133
South Carolina	140,195	2,777,705	212,521	2,651,825
Georgia	337,603	5,739,251	598,656	6,538,930
Florida	52,822	862,055	570,912	4,941,078
Alabama	296,787	4,570,520	445,139	4,187,825
Mississippi	285,904	4,445,807	428,909	4,064,000
Louisiana	162,649	2,651,179	270,816	3,069,187
Texas	772,716	10,972,567	6,386,504	63,077,993
Arkansas	304,404	4,453,431	469,057	4,603,415
Tennessee	339,572	6,706,547	461,239	5,815,073
West Virginia	171,273	4,122,541	280,892	5,196,913
Kentucky	313,953	7,629,058	529,018	11,237,676
Ohio	783,481	22,877,645	967,540	24,766,690
Michigan	437,303	12,681,787	511,406	12,865,948
Indiana	556,961	15,455,668	604,344	20,066,941

Table showing the estimated number and value of cattle on farms in the United States January 1, 1888—Continued.

States and Territories.	Milch cows.		Oxen and other cattle.	
	Number.	Value.	Number.	Value.
Illinois	937, 476	\$24, 843, 114	1, 485, 754	\$33, 029, 792
Wisconsin	548, 222	13, 064, 130	640, 752	13, 438, 163
Minnesota	433, 966	10, 306, 693	489, 886	9, 974, 076
Iowa	1, 253, 432	29, 251, 566	2, 005, 253	42, 633, 795
Missouri	737, 259	14, 920, 495	1, 423, 453	26, 077, 367
Kansas	640, 081	14, 344, 215	1, 583, 915	32, 271, 946
Nebraska	357, 202	9, 108, 051	1, 079, 646	22, 768, 690
California	250, 773	8, 275, 509	692, 287	14, 194, 447
Oregon	78, 997	2, 338, 311	598, 218	12, 172, 122
Nevada	18, 037	631, 295	323, 400	5, 819, 648
Colorado	62, 023	2, 345, 086	1, 049, 353	20, 918, 327
Arizona	16, 298	606, 286	420, 000	7, 560, 000
Dakota	223, 418	4, 841, 468	767, 809	16, 687, 171
Idaho	26, 458	705, 635	424, 316	7, 955, 925
Montana	31, 132	884, 149	984, 500	17, 948, 007
New Mexico	19, 394	460, 608	1, 257, 597	18, 911, 121
Utah	49, 878	1, 259, 420	435, 000	7, 232, 733
Washington	65, 523	2, 181, 916	300, 676	7, 060, 177
Wyoming	6, 994	244, 790	1, 230, 192	23, 504, 663
Indian Territory			626, 937	9, 090, 587
Total	14, 856, 414	366, 252, 173	34, 378, 363	611, 750, 520

The marked difference in value of the cattle in different parts of the country results from several causes. Climate and soil, with consequent cheapness or dearness of cattle foods, have had much influence, but much of the present variation in quality is dependent upon differences in the foundation stock and the interest taken in its improvement. The cattle brought to the more northern States were generally from Great Britain; those in the most southern and southwestern regions came largely from Spain. The former were of higher average merit, and have had better care and more attention to systematic improvement than have the latter, more especially until within quite recent years.

It is a remarkable fact that there is no generally recognized breed of improved cattle which has had its origin in the United States. The common or misnamed "native" cattle of different sections often have such distinctive characteristics as to entitle them to be classed as distinct breeds, but they are not of high merit, unless, indeed, in adaptation to local conditions, which are often very unfavorable.

Coupled with better care and wiser selection of breeding animals from the stock on hand, large attention has been given, for the last fifty or sixty years, to the importation and subsequent breeding of pure-bred cattle of the most prized breeds of Great Britain, and in much less degree to those of a few breeds from western continental Europe. Of the breeds so introduced may be named: Ayrshire, Devon, Galloway, Hereford, Holstein-Friesian or Holland, Jersey, Polled Angus or Aberdeen, Red Polled or Norfolk and Suffolk Polled, Shorthorn or Durham, Sussex, and a very few Swiss, West Highland, Kerry, and Normandy cattle, and even a few from India and China.

Of these breeds the Shorthorn has had by far the most influence in improving the cattle of the country, especially for beef production. Among the first to be introduced and kept pure, it soon gained wide popularity, and is still the most widely distributed and by far the most numerous of the improved breeds of the country. More than 90,000 pure-bred bulls of this breed have had their pedi-

greys recorded in the American Shorthorn Herd-Book, about 40,000 of these having been recorded within the last five years. A much larger number of pure-bred or "high-grade" bulls of the breed have been used without public record of the pedigree. Much attention was formerly given to breeding thoroughbred Shorthorns in the more eastern States, but now the largest number of herds are to be found in the group of seven States previously named, and in Kentucky, Michigan, Wisconsin, and Minnesota. The large size, early maturity, fine beef form, good feeding quality, quiet disposition, and attractive colors of this breed, together with a good degree of merit as dairy cattle, when attention is paid to the development of the milk-giving habit, have admirably adapted this breed for much of the chief beef-making region of the country. It has suffered from over-attention to certain fashions in breeding, as undue estimate of the red color, and over-appreciation of the value of certain families, with absurd under-appreciation of other families, but the good it has done has been incalculable, and it retains a first place in the estimate of a large number of the best beef-producers of the country.

The second in number of the breeds best adapted for beef-making is the Hereford. Although imported to the country more than sixty years ago, this breed attracted little general attention until within the last fifteen years, although it has always had a few enthusiastic admirers. Owing, in a large part, to the skillful and persistent efforts of a few breeders, the Herefords with remarkable rapidity became a popular breed over nearly all the region in which the Shorthorns had long been without a serious rival. Men of wealth, enterprise, and intelligence interested themselves in the breed; hundreds of animals were imported in each of several successive years. They were well shown at the leading agricultural and fat-stock shows, and met with much favor. Nearly equaling the Shorthorn in average size, fully as early in maturity, uniform and attractive in color, with a longer and thicker coat of hair, and every appearance of great hardiness, usually short-legged, with deep, compact bodies, admittedly of unusual excellence as grazing beasts, they became the favorite breed of many, and were especially popular with many seeking to improve the cattle on the great ranches of the far West.

The third in number of the distinctive beef breeds is the Polled Aberdeen-Angus. The rise of this breed in public esteem was almost or quite as remarkable as in the case of the Herefords. It had to overcome a very considerable prejudice among American cattle-growers against the black color, but was helped, on the other hand, by its lack of horns, a wide-spread feeling that horns are a serious disadvantage to cattle, especially to those to be fed outside stables, having been developed in recent years. Unsurpassed in compactness of body and lightness of offal, and in symmetry and finish of the best specimens, the marked success of the breed at the great Paris Exposition of 1878, and at prominent British shows, was followed by striking success in American show-yards. With large importations and skillful breeding by a considerable number of men of large wealth and business sagacity, the merits of the breed were presented with a degree of skill probably not equaled in the case of any other breed, and the Angus won and retains a high place in the esteem of many of the best American cattle-breeders. With this breed may be mentioned the Galloway. Resembling the Angus in color, in lack of horns, and in form so closely that the average cattleman distinguishes them with difficulty, with the persistent claim in its

behalf of superior hardiness, this breed has met with a good degree of favor.

The Devon, early introduced into the country, has always been the favorite with some, and has merit freely conceded by all—a beautiful red color, often excellent form, much hardiness and activity, producing beef of fine quality, and yet has never been widely popular. The chief objection has been lack of sufficient size. There is no instance in which any breed of animals chiefly designed for meat production has secured, or at least retained, wide-spread popularity, unless it was above medium size for its class. In the last few years the Sussex, a breed which in color and in some other characteristics, may be popularly described as larger Devons, have been imported and bred in small numbers and have attracted much favorable comment, but, as yet, the breed has had no perceptible effect on the cattle of the country. Something like this is also true of the Red Polled breed from Norfolk and Suffolk, England, of which there are one or two thousands in the country, which breed is meeting favor as possessing merit for both beef and milk production, with a popular color and absence of horns.

The Ayrshire, a favorite of some dairymen, has never been largely bred in the chief beef-making regions.

The large black and white cattle of Holland, now known in the United States as Holstein-Friesians, have been largely imported and bred, have won high favor in dairy regions, and have had some influence on the beef production of the country. Often a little coarse in form, the good size and rapid growth of the calves have given the breed favor with a considerable number of farmers who combine dairying with beef-making.

The Jersey is undoubtedly only second to the Shorthorn in number in the country, and has been exceedingly popular among butter-making dairymen. Naturally it has made little headway in the great beef-making regions, and cross-bred calves produced by the use of Jersey bulls in dairy herds have, as a rule, not been kept to maturity. Except that they have not been imported or bred in equally large numbers, the same comment may be made on the Guernseys.

Of other breeds, so few have been imported that they are objects of curiosity to most cattlemen rather than serious factors in improving or injuring the beef product of the country.

The Texas cattle should be mentioned, not because of merit, but because of their large numbers, striking peculiarities, and marked influence on the beef product of the country, especially in former years. The descendants of the Spanish cattle brought to the West Indies and Mexico, they bred in enormous numbers on the plains of Texas, retaining many of their characteristics, but becoming lighter in body and flesh, longer and fleetier of limb, wider in spread of horn, wilder in disposition, and slower in coming to maturity. When well fattened their flesh was of good quality, but they were unprofitable except under such conditions as produced the breed. Of recent years large numbers of bulls of the improved breeds have been used in Texas and other southwestern districts, and the quality of the cattle has been perceptibly improved. The typical Texas steer will probably become a thing of the past within a few years.

The influence of cattle of improved blood has been very great, but the large majority of the cattle are yet chiefly of common or unimproved blood. There is no means of determining exact percentage, but it is believed there is no State in which one-half of the cattle can

be properly classed as even "half-bred." The smallest percentage of improvement is to be found in the extreme West and South, the largest, so far as beef production is concerned, in the central western States.

The breeders of pure-bred cattle rank among the most intelligent and progressive of American farmers. To their efforts much of the improvement in the cattle of the country is due. It is also true that many of them have found the business very profitable. There have been great fluctuations in value, times of depression, followed by years characterized by ready sales at high prices. Unfortunately there has been a time of unusually depressed cattle markets for two or three years past. The year 1888 was one of the least satisfactory to either breeders or feeders that has been known for many years. Some of the causes are easily seen. Among the chief may be named the remarkable development of cattle-rearing on the far western plains. Under the conditions found there of practically free land, with a climate such that the sparse grass dried where it grew and left passable food during the winter, it was possible to produce moderately good cattle at very low cost. Vast sums were invested in these western cattle ranches, and the supplies from them became enormously large. The demand for cattle with which to stock these ranches gave a stimulus to cattle-rearing in the central western States, and in some degree reduced the supplies sent to the ordinary markets. After a few years the proprietors of many of these ranches found that the losses from severe winters and other causes resulted in a net loss instead of the expected profit. This caused a disposition to reduce the numbers by increasing the shipments to market. The demand for breeding-stock for the ranches largely ceased. The year 1887 was characterized by severe drought over a large area and a decreased corn crop. Increased shipments to market, often of only partially fattened cattle, naturally followed. Lower and lower prices followed, with increasing discouragement to producers and increasingly large shipments, often of calves or breeding females.

The receipts of cattle at Chicago in 1888 were about 230,000 in excess of those in any previous year. They were 2,611,543, aside from about 100,000 calves. This is an average of 50,000 for each week. In one week over 70,000 were received, with over 20,000 in one day. The year 1889 opens with almost unprecedentedly low prices for both fat and breeding cattle. It is believed, however, that a reaction is not far distant, and that fairly remunerative prices will again prevail. There is no reason to believe that cattle rearing is to cease to be a leading industry among the farmers of the United States.

In a country of such vast extent there is great variation in the systems of management. Those of most general interest are the ones pursued in the regions which furnish the largest numbers of cattle or beef for the great markets of the country. These are chiefly the two regions already described as the great maize and grass producing States in the central West and the grazing lands of the still further West.

In contrast with the best systems in older countries, or even those most favored in the older settled portions of the United States, the cattle rearing and feeding of these regions seems rude, often wasteful of land and food. The one thing most carefully husbanded is human labor. Judged by adaptation to the circumstances, or by the quality of much of the product, the systems pursued in the West are good.

There are many farms on which cattle-rearing is the leading feature. On these the rule is to allow the calves to suckle the cows, often allowing them to run together in the pastures during the summer and early autumn months, weaning the calves when they are six or seven months old. This is the almost universal custom on the great ranches, except that on these the cows are often allowed to suckle the calves as long as they will. After weaning, the calves, in the great grain-growing regions, are liberally fed, most commonly with shelled corn and oats, with hay, straw, and corn fodder during the winter; the bull calves, of course, being castrated at the time of weaning or before. As yearlings the cattle are usually simply allowed the range of good pastures, without grain, although the practice of summer grain feeding is becoming more common. It is still the rule that the young steers are kept through the second winter as cheaply as is consistent with maintaining fair condition, allowing them to run in the fields from which the corn has been husked, giving them straw or corn fodder and some hay and grain. In the more southern portion of the region in question much is made of winter pasturage. It frequently happens that the cattle can get most of their food throughout the winter from pastures which have been kept in reserve for them. In the more northern regions less reliance can be had on winter pasturage, and more attention is given to sheltering the cattle by means of sheds, etc. Even in States in which the weather is at times quite cold, only a small proportion of the steers are kept in stables. Shelter belts of trees planted for the purpose, or bits of natural forest, are frequented by the cattle during storms. Where the numbers are smaller they are allowed to have free access to stacks of straw, utilized both for food and shelter.

Not infrequently the steers are again allowed to get their food from the pastures alone, but an increasing number of steers is now fattened when they are two years old. If this is purposed, many good cattlemen will begin liberal grain feeding in the late winter, continuing this after the cattle are put on the grass and until a satisfactory price is secured, sometimes giving practically all the grain the steers will eat for a year or more. The chief food is Indian corn, either in the ear or shelled, fed in troughs in the pastures or in the yards in winter. It is a common practice, however, in winter, to feed the stalks with the ears, either in large racks made for the purpose, or, wasteful as the practice seems, scattering the bundles of stalks over the fields. The grain uneaten by the cattle and that which passes through them undigested is gathered and readily eaten by hogs, which are allowed to follow the cattle. A few years since it was a more familiar sight than now, on the prairies of Illinois or Iowa, to find droves of a hundred or more fine beeves in large grass fields, scattered over which would be seen large troughs into which there would be daily thrown wagon loads of ear corn, or, in the winter, great loads of "shocked corn," with about an equal number of hogs, fattening without any direct attention.

In 1888 there died, at his home in central Illinois, Mr. John Gillette, the most notable producer of fine beef cattle, on a large scale, in the United States. He had accumulated by his own exertions a tract of land nearly 20,000 acres in extent, on which there could be found two or three thousand cattle of all ages. He kept several hundred high-grade Shorthorn cows, rearing the calves, and annually buying hundreds of steers. Within the last ten years he had

changed his plans so far as to usually fatten his steers at two years old, instead of keeping them until they were four or five years old, but to the last he adhered to this simple system of outdoor feeding, and without stabling his cattle. That his cattle were of the first rank was abundantly demonstrated, but many thought that the increasing value of his lands and the higher prices for corn had so changed the conditions that greater profit would have been secured from systems more careful of the food used. His was the most marked instance of success in a system practiced by hundreds.

There are many thousands of farms in the great cattle-growing region, farms of more moderate extent, on which cattle are not the chief product. Thus there may be ten or twenty cows. In many cases these are milked, butter made, and the calves reared on the skimmed milk. In many other cases, where the cows suckle their calves, a second calf is purchased and reared after the first is weaned. The calves are fed grain or meal as soon as they will eat it. Among farmers of this class who make butter-making somewhat prominent, having the calves dropped in the autumn rather than in the spring is frequently preferred, not only because winter dairying is more profitable but because it is believed the calves do better, as they are well grown when put on the pastures in the spring, and come to the second winter better fitted for it than does the spring-dropped calf to its first winter. Partly because he has a smaller number, such a farmer as we now have in mind more frequently provides shelter in winter for all his cattle. Frequently he buys from neighbors, in regions in which corn is less abundant, steers one or two years old to fatten with those reared on his own farm.

There are few methods in which beef is produced at lower cost, where grain is used at all freely, than by many such farmers, who buy yearlings or two-year-old steers at the opening of winter, keep them through the winter on coarse and low-priced food, give them abundant grass the next summer, and, as the Indian corn begins to mature, about September 1, commence feeding this liberally, at first cutting the stalks, which are readily eaten, later pulling the ears from the stalks without removing the husks, and still later feeding the husked ears. Good steers will frequently add 250 to 275 pounds to their weight in three months by feeding on the grass in pleasant autumn weather, often adding 1 cent per pound to their value. The one chief disadvantage to this method is that the cattle go to the markets at a time when these are especially crowded with the grass-fattened cattle from the plains, with consequent lower prices.

There is a growing appreciation of the gain from more early maturity in cattle, and the average age at which beeves are sent to market has been steadily reduced of recent years. But it is still true that the percentage of yearlings slaughtered is small. There is a wide-spread belief that from thirty to thirty-six months old is the more profitable age, under generally existing conditions.

As was to have been expected, with the growing density of population, advance in the price of farm lands and of feeding stuffs, there is a rapidly increasing number of cattle reared and fattened under careful management in every regard. This is more especially true in the eastern and northern portions of the beef-making regions. Many thousands of beeves are annually stall-fed in comfortable stables, and fed on carefully prepared rations, in which, while Indian corn usually is a chief element, oats, bran, and oil cake are freely used. Thousands of cattle are annually fed on the by-prod-

ucts from distilleries, etc. Aside from such establishments, the practice of feeding cooked foods is exceptional. Grinding various grains and feeding them with chaffed hay or straw is a quite common practice. Maize ensilage is now used on thousands of farms, most commonly being fed to dairy cows, but an increasing number are feeding this to beef-cattle, and with satisfactory results.

There has been a considerable change in the market demands of recent years. Extremely large cattle are less common than formerly, although the average weight of the cattle sent to the leading markets is doubtless greater than formerly. The highest prices are now often secured for young, smooth, well-fattened steers, weighing not more than 1,350 to 1,450 pounds. While large numbers of inferior cattle are still sent to the great markets, the local butchers consume a great percentage of these. It is not an uncommon remark that residents in the country and smaller towns in sections from which thousands of high-class beefs go to the great markets, rarely have an opportunity of eating beef from such cattle.

The cattle shown at the fat-stock shows annually held for several years past at Chicago may be taken as well representing the highest excellence yet reached by cattle-feeders in the United States. The average of steers of the leading breeds exhibited at this show for eight successive years was, in round numbers, 1,850 pounds for three-year olds, 1,500 pounds for two-year olds, and 1,303 pounds for yearlings. The maximum weights in many cases were largely in excess of these averages. At the show held in November, 1888, weights of 2,080 pounds for two-year olds, 1,600 pounds for yearlings, and 1,070 pounds for steers under one year old, were recorded.

The story of the methods of cattle management on the great ranches of the western plains has often been told. With many points of difference the great ranch region, extending from Texas on the south to the British possessions on the north, is characterized by a scanty rain-fall during the summer and autumn. The wild grasses do not make a great growth at best, and when the drought comes on they dry into hay upon which the cattle can live during the winter. The great mass of these lands are still owned by the Government, the light rain-fall making them unsuited for agricultural purposes. On these vast areas, of hundreds of thousands of square miles, herds, frequently of half wild cattle, are bred and reared, and often without any other food than the natural grasses, and with little attention save at the annual "round-ups," at which the cattle grazing over an area as large as some of the smaller States are collected and separated according to their brands, the calves branded, the males castrated, and the cattle best fitted for market put in separate droves.

During severe weather the losses of these cattle are sometimes very great. Of recent years it is coming to be recognized that there must be considerable modifications of the system. The scanty pasturage and the fact that water for the cattle is sometimes only found at points a number of miles from each other, make it difficult or impossible to conduct the business on a small scale, and there are serious obstacles to confining the herds within inclosed fields. It is found practicable, in some regions, to cut sufficient hay for use during severe storms in winter, but even this is not possible in many parts of the range country. The good size, marked vigor, and healthfulness and very fair degree of flesh carried by cattle which have had no other food than wild grasses since weaning time, is a surprise to those not familiar with the facts. In the great cattle markets the

better quality of the range cattle are preferred by buyers to the grass-fattened cattle from farms.

Some years since many young cattle were driven from Texas to the more northern ranges to be matured, but more recently the supply of cattle bred there has been sufficiently large. On the part of many of the cattle-owners commendable efforts have been made to improve the quality of the herds by the purchase of large numbers of pure-bred or high-grade bulls. The change in the conditions of life was so great with these that many of them died, but there has already been a very noticeable improvement. The Hereford, Shorthorn, Angus, and Galloway breeds have been chiefly used for this purpose. It is undoubtedly true that many rangemen prefer a bull with comparatively little of the blood of the improved breeds, believing the better bred animals have less of hardiness and are less fitted to withstand the privations unavoidable at times.

It is probable there will be very considerable changes in the ranching system in the near future. As hitherto conducted it has not proved permanently profitable in very many cases. Something of a reduction of the total numbers kept, with closer supervision, probably the utilization of the regions which can be irrigated for the production of hay, millet, etc., are lines of change believed probable by many.

An interesting feature which has become common in the last few years is the shipment of large numbers of cattle from the ranges for fattening in the regions in which Indian corn is most cheaply produced. There are establishments in Nebraska, for instance, fitted for fattening some thousands of cattle in stables arranged with every convenience.

There is every reason to believe, however, that by far the largest percentage of the better grades of beef-cattle will continue to be reared and fed in the States properly classified as corn and grass States.

SWINE BREEDING AND REARING.

The United States stands easily first among nations in the number of its swine. There has been some decrease in the last few years, but the estimates of the Department of Agriculture gives the number, January 1, 1888, as 43,544,755, or nearly 75 for each 100 of human population. This estimate is made at the season of the year when the total number is nearly at its minimum, as a very large percentage of the pigs are produced in the spring months, and vast numbers of fattened hogs are sent to slaughter during the closing months of the year.

The abundant and cheap production of Indian corn is the controlling factor in pork production in the United States. Thus the seven great corn-producing States are estimated to have had, in round numbers, 20,800,000 hogs, or almost half the total number, and an average of nearly 3,000,000 for each State. Their respective rank was, Iowa, Missouri, Illinois, Ohio, Kansas, Indiana, and Nebraska. No other State had 2,000,000 hogs save Texas, and the poor quality of these largely offset the large number.

The rapidity with which swine increase, the early age at which they may be profitably sent to market, the ease with which the meat may be preserved for future use, and the large use made of the fat, as also the abundance of maize so well adapted as a fattening food,

have made swine breeding popular in all the great Indian-corn-growing regions, while the readiness with which one or more pigs may be utilized as profitable means of consuming waste products from the table and dairy have caused farmers and many village residents in almost every part of the country to annually fatten at least a few pigs.

Much attention has been given to the improvement of the hogs of the country, and it is believed those of no other country surpass the best in the United States.

There is a large number of distinct breeds, but several of these closely resemble each other, except in comparatively unimportant characteristics, and there is a noticeable tendency in the most popular breeds towards greater similarity. Early maturity, medium to large size, quiet disposition, and the ability to lay on flesh rapidly, even at an early age, are the qualities chiefly desired. No breed not above a fair medium size is in general favor in the great pork-producing regions, although several of the smaller breeds are highly prized for village pigs or on farms where but few swine are kept. It is also noticeable that swine of the dark-colored breeds far outnumber those white in color.

The breed most generally found on the farms in the great hog-rearing States is the Poland-China—a name somewhat inappropriately given to a breed originating in southwestern Ohio as the product of crossing hogs of various breeds, among which were hogs imported from China, and, in the opinion of a minority, some brought from Poland. The Berkshire was used at different times. Whatever its exact origin, the Poland-China has now marked uniformity. It is almost entirely black in color, although there is little prejudice against white spots on any part of the body. The ear droops at the side of a moderately dished face. The body is deep, legs short. The disposition is noticeably quiet. While reaching great size at maturity—weights of 1,000 pounds not being unknown—the young pigs of this breed are readily made fit for market.

The Berkshire stands second in number and general popularity, and, perhaps, may be said to be a more fashionable breed than the Poland-China. As bred in the United States it retains the characteristics which made it popular in England. It is unusually uniform in color and appearance, the white extremities and black-haired body, erect ears, dishing face, somewhat prominent shoulders, well-rounded body, large hams, and appearance of vigor and vitality being readily recognized by any one who has seen even a few specimens. Of late years the average size has been increased without injury to the superior quality of the flesh.

The Chester White is the name of another breed of American development, the name being that of the county in Pennsylvania in which it first gained celebrity. Various crosses were used in producing the breed, and probably quite as much of its good reputation was due to skillful selection and good management on the part of breeders as to the merits of the foundation breeds. Except for its white color it is not unlike the Poland-China. The prejudice against white hogs on the part of so many farmers is a chief reason why it is not more widely bred, as no breed has more earnest friends among good swine-raisers.

Within the last ten years much favorable attention has been attracted by a breed known by different names and the origin of which it is not easy to fully trace, but now most generally called the Duroc-

Jersey, the first name having been arbitrarily given, the second referring to New Jersey, in which State these hogs were largely bred. Many are of a dark red or "sandy" color, of large size, and as bred a few years ago somewhat coarse in bone. They are hardy, and when crossed on breeds which had become, perhaps, overly fine-boned, the results were often very satisfactory. The breed has a good standing in most of the leading pork-producing regions.

Of other breeds, of which there are large numbers, although small in comparison with the total number of swine in the country, may be mentioned the Essex, a pure black breed of small to medium size, and the small Yorkshire, of similar size, but white in color, both breeds being noted for early maturity and the great ease with which they can be fattened, and both well adapted for crossing with the larger breeds. There are a number of other breeds of good repute in comparatively limited localities.

A much larger percentage of hogs than cattle are nearly or quite pure bred or else are the product of intentional crossing of distinct breeds. Many good hog-raisers believe cross-bred animals are preferable to those nearly or quite pure of one breed. In some parts of the country, especially in some of the more southern States and in regions where the abundance of forest trees tempts the farmers to allow their hogs to get much of their living from the nuts and roots, the hogs are of inferior quality, often slow in coming to maturity, and of small size, wild in disposition, active and muscular. But the animals of this description form but a small minority of the total.

As in the case of the cattle the methods of swine rearing and feeding most approved in the United States, as shown by most general practice, are characterized by simplicity, the absence of complicated rations, and anything which tends to much increase the quantity of human labor necessary. There is much diversity in the methods pursued with village-kept pigs or those reared in sections where land and grains are high priced, but these pigs are chiefly designed for home consumption, rarely reaching the public markets.

In striking contrast with modes of keeping in many countries the traveler among the farms where hogs are chiefly grown in the central West will, during the summer, almost as certainly find the hogs grazing in the fields or in large grass or clover plats especially reserved for them as he will the cattle. This general recognition of the fact that the pig is a grazing animal has much to do with the cheapness with which pork is produced and does much to secure healthfulness among the hogs, largely counteracting the ill effects produced by another practice concerning which there has been much adverse criticism of American farmers—that of using Indian corn too exclusively in fattening hogs and as their food ration during the winter months.

The more common practice in the Western States among farmers who rear from a score to one or two hundred pigs each year, is to have the litters dropped in April or May; if early, in comfortable but often very cheaply constructed shelters; if later, in the field or grass yards prepared for them. As early as practicable the pigs are taught to eat grain, are fed corn, oats, or rye, sometimes dry, but frequently soaked in water or in "slops," or ground and mixed with milk or water. Generally large liberty is given. The practice of "ringing," or inserting a wire ring in the nose, thus preventing rooting, is very common, and allows the greater freedom on the grass and clover land, of which there are usually small fields espec-

ially fenced for the hogs. The pigs are weaned at from eight to ten weeks of age, after which the sows are frequently at once put on full grain feed and sent to market in the early autumn or are bred so as to produce a second litter in the autumn.

The practice of fattening the earlier litters of pigs, so as to send them to market when from eight to ten months old, is growing in favor. The later litters, and those dropped in the autumn months, are kept over the winter and fattened either in the spring or next autumn. Except the brood sows, but a small proportion of the hogs in the best pork-growing regions are now kept until they are eighteen months old.

As has been stated hundreds of thousands of cattle are annually fattened in the Western States by feeding them Indian corn either "in the ear" or shelled, but unground. A considerable percentage of the grain so fed passes through the animal undigested, and it is almost an essential to profit that this grain should be secured by hogs. While the practice is sometimes regarded as offensive by the fastidious, there are few methods of feeding by which hogs can be made to grow more rapidly or be kept in more vigorous health than when they have an abundance of such grain and also good grass and clover.

When cattle are not so fattened it is a common custom to feed the growing pigs about half as much grain as they would eat during the summer, letting them get the remainder of their food by grazing. As soon as the maize is in or a little past what is known as "roasting-ear" stage, liberal feeding of this is often commenced, in many cases the stalks being cut and fed with the ears. Of this green corn hogs are very fond and gain in weight rapidly on it, especially if they have not been grain-fed during the summer. For finishing the fattening process, mature corn is preferred. The fattening period proper rarely continues over eight to ten weeks. During this time, especially as colder weather comes on, the hogs are most commonly kept in smaller inclosures, so as to keep them more quiet. Many farmers, but only a small percentage of the total, keep their hogs in small pens or houses almost continuously, either because, under some especial circumstances, this is the more convenient method, or with a view to securing especially rapid development. Large numbers are fattened at cheese factories or other factories at which there is a considerable by-product of vegetable or animal matter, but, relatively, these are exceptional methods. This may be said to be true, in a measure, of feeding ground grains or cooked foods to fatten hogs, although the use of meals, bran, and of oil cake is practiced by thousands. It is certainly true that the great mass of the hogs which are slaughtered in the great markets of the country have been fattened almost exclusively on Indian corn, grass, and clover.

Two notable changes in the market demands in comparatively recent years have greatly influenced the practice of breeders. These changes are, a vast increase in demand for hogs of comparatively light weight, and a fairly uniform demand throughout the year. Formerly the percentage of hogs slaughtered in the summer months was very small, and the largest demand was for heavy weights. Now large numbers are slaughtered every week during the year, the highest prices often being paid during the spring or early autumn months, and there is a very large demand for hogs weighing 200 pounds or less. The average weight of all the hogs received in Chicago in 1887 was 228 pounds, in 1888, 229 pounds. The average

weight of those received in December, 1888, was 262 pounds, an unusually heavy weight, largely consequent on an abundant and rather low-priced crop of Indian corn.

The hogs exhibited year after year at the fat-stock show at Chicago may be taken as typical specimens of the best fat hogs of the country. While the weights are often great for age, considerable regard is had by most exhibitors to quality of the carcass and symmetry of form. The average weight of the hogs of all breeds and crosses, over one year and under two years, exhibited at this show during eight consecutive years, was 436 pounds; of those under one year the average weight was 303 pounds. The heaviest hogs over one and under two years at these shows averaged 591 pounds, at an average of four hundred and twenty-eight days, or a gain of 1.15 pounds per day from birth. Of those under one year the average was 269 pounds, at two hundred and seven days, or 1.30 pounds gain per day. The percentage of weight of dressed carcass, including head, to live weight of the hogs slaughtered at this show, during a series of years, was 86.

Few classes of live-stock breeders in the United States have manifested more skill, energy, and perseverance than have the breeders of pure-bred swine. Each breed is represented by national and State associations, and each has one or more public records of pedigrees. Many of the animals that are recorded can be traced back for several generations. Remarkably high prices are often paid for choice animals for breeding purposes. There are some hundreds of intelligent farmers who make the breeding of pure-bred swine the chief or a leading part of their work. From some of these breeding farms there are annually sold from 500 to 1,000 well-bred pigs to be used as sires or dams by other farmers who rear hogs chiefly for the general pork markets. These breeders have done much to improve the hogs of the country and to stimulate interest in swine husbandry. On the other hand the large number engaged in such breeding, and their general prosperity, is evidence of the adaptation of the soil, climate, and crops of the country to profitable swine rearing.

The chief obstacle to the further extension of the industry is the occasionally great loss caused by disease, popularly known as hog cholera. In some years the losses from this cause have been enormously great. Fortunately, during the year 1888, there was comparatively little of disease, and pork-producers have received prices giving a fair profit. The unusually light crop of Indian corn in 1887 did much, however, to reduce the number reared in 1888, the total number slaughtered during that year being considerably less than the average for recent years.

Naturally the center of the pork-producing district is moving westward with the growing population of the great corn-producing States west of the Mississippi River. Taking the chief hog-raising States as a whole, and the average value of Indian corn on the farms where produced is certainly not over one-half cent per pound. Judiciously fed to good hogs, from 5 to 6 pounds of corn will produce a pound of pork; under favorable conditions 4 pounds will cause a pound of increase. A good part of the weight of the fattened hog has been made at even less cost, from grass and clover, or from food that would otherwise have been wasted. One year with another the producer has been able to get at least 4 cents per pound for his live hog. It is evident that, if there were no losses from disease or other unfavorable circumstances, the business would give a good profit, with a probability that the numbers reared would soon be so

great as to materially lower prices. There have been marked fluctuations both in numbers and price, in recent years, with some reduction of the total number. From various causes the exports of pork to foreign countries have fallen off. Lower prices for beef and a growing appreciation of mutton have tended to check the home demand. But there is every reason to believe that the United States will long remain the greatest swine-rearing nation, and that pork production will continue to be a profitable branch of American agriculture.

LEATHER PRODUCTION OF AMERICA.

By ISAAC H. BAILEY, Esq., of New York.

There were 11,773,171 hides and 19,936,658 skins tanned in the United States in 1880; 23,812 men were employed in tanning and 10,885 in currying the leather. Value of product tanned, \$113,348,336, of curried leather, \$71,351,297. The production for 1888 may be estimated at from 25 to 30 per cent. above that of 1880.

The exports of leather and leather manufactures for the past five years have been:

1884.....	\$8,305,779	1887.....	\$10,436,138
1885.....	9,692,408	1888.....	9,583,411
1886.....	8,737,682		

The leather is tanned by placing the sides in vats filled with liquors extracted from bark and agitating them at frequent intervals; light sides are sometimes sewed in bags and the tan liquors forced gently through the pores. This does not include "oil and alum tanned," which is simply *tawed* leather.

The varieties of leather made in the United States from domestic hides and skins, with methods of tanning and finishing, are:

OAK SOLE.

This is made from green salted or dry domestic hides, the former chiefly. Hides are soaked in water from one to three days, fleshed, then put in limes and wheeled from one pit to another from three to five days. The limes are cold and the process loosens the hair. The hides are taken out, unhaired over the beam, washed in pure water and worked on the grain to remove superfluous lime; then handled in weak, sour liquors for three weeks; then laid away in fresh oak liquors and ground oak bark for three or four months; then washed, oiled, dried, dampened, and laid in piles to sammy, and rolled.

If scoured backs are made, the hide, after tanning, or when partially tanned, is trimmed and scoured on the grain. This leather is used mainly for the soles of fine shoes. Backs are tanned of whole hides, from which the heads and bellies are trimmed off when partially finished. The scoured backs are the highest-priced sole-leather made.

UNION SOLE-LEATHER.

This is made almost entirely from green salted hides. It is tanned with liquors made of oak and hemlock bark, the latter largely predominating. The hides are soaked from one to three days, fleshed,

put in lime four or five days, unhaired, put in clean water, taken out and worked on the grain; then handled in weak, sour hemlock liquors about three weeks; then laid away in fresh hemlock liquors and bark three or four months, but dusted down in the "lay-aways" with plenty of oak bark, ground fine, taken out, washed, oiled, dried, dampened, and rolled. Bellies are struck through and trimmed off after about six weeks in tan. Heads are cut off from the hides and usually tanned separately.

Union leather is popular in this country. The production of it increases steadily. It is used largely for soles of women's shoes. Heads and bellies cut from it are exported in considerable quantities.

HEMLOCK SLAUGHTER SOLE-LEATHER (TANNED WITHOUT ACID).

Hides are split, soaked, fleshed, limed two days, handled a day in hot water, and then unhaired and taken to weak, sour liquors, where they are handled two weeks, then laid away in liquors of 12 per cent. strength two weeks, then changed to fresh liquors of 16 per cent. for three weeks, then to liquors of 18 to 20 per cent. for a month, and then to liquors of 25 per cent., and they lay there a month or more, then are taken out, washed, oiled, hung to dry, dampened, sammied, and rolled. This leather is bought and sold by the dealers in findings and shoemakers' materials. It is useful for custom work and cobbling. To some extent it is exported to Northern Europe. It is the highest-priced hemlock leather made here.

HEMLOCK SLAUGHTER SOLE (ACID LEATHER).

Hides are split down the back, then soaked one to three days, fleshed, put in lime two days, handled in hot water one day, unhaired, washed, and hung in vats on sticks in weak coloring liquor one hour, taken out and hung in vitriol vats forty-eight hours in a weak solution of sulphuric acid and water; then handled in sour liquor two weeks, laid away in fresh hemlock liquors three to five months, or handled in the extract; then oiled, dried, dampened, and rolled. This sole-leather is exported to some extent. Most of the leather sent abroad is tanned with acids. At home it is used for bottoming shoes which are designed for service rather than for show.

HEMLOCK SOLE FROM DRY HIDES (NON-ACID).

Hides are soaked two weeks, split, softened in a hide-mill, hung in sweat-pits five to seven days, to unhair, taken out, worked in hide-mill to unhair, also over the beam, then fleshed, handled in weak, sour liquors ten days; then put in sweet hemlock liquors, say of 12 per cent., two weeks, then 16 per cent. three weeks, then 18 per cent. four weeks, and in 25 per cent. a month; then washed, oiled, hung to dry, dampened, sammied, and rolled. This leather is used in all kinds of cheap shoes. It is soft and pliable, and works well under the sole-sewing machine. There is not much of it exported, but its home use is universal.

HEMLOCK SOLE FROM DRY HIDES (ACID LEATHER).

Domestic and foreign hides are used, which are first soaked about two weeks, split down the back, and then put in hide-mills to soften them; then hung in sweat-pits, well protected from the weather,

where decomposition sets in. The pits are kept damp and warm. In five to seven days the hair starts; they are then taken out and worked in hide-mills, which forces nearly all the hair off. Some tanners lime a little after sweating. When hair and flesh are removed, sides are thrown into water, colored, plumped in acid-vats forty-eight hours, then washed, oiled, dried, dampened, sammied, and rolled. Most of the sole-leather exported is made by this process.

The following table shows the number of pounds of sole-leather exported for ten years past and its value:

Years.	Pounds.	Value.	Years.	Pounds.	Value.
1879	28,719,623	\$4,846,882	1884	28,421,293	\$4,613,106
1880	21,831,492	5,086,118	1885	27,312,706	5,416,831
1881	28,690,648	6,472,695	1886	24,265,830	4,825,615
1882	33,777,711	7,059,906	1887	30,530,488	5,695,151
1883	28,593,894	6,038,097	1888	28,713,473	4,959,363

HARNESS-LEATHER.

Domestic steer-hides, free from brands, scores, or horn scratches, are used for making harness-leather. The hides are washed, green fleshed, and limed five days by reeling over from one lime-vat to another, the last vat having the strongest lime water; then put in a fresh-water pool, and worked through an unhairing-machine to cleanse thoroughly of lime and hair; then hung on frames in vats containing weak liquors for three weeks. After this some split the hide into sides, others wait until the tanning process is completed. After the manipulation of the hides or sides, they are handled two weeks with tanning liquors, then laid away in liquor and bark from seventy-five to ninety days, then taken out, washed, shaved on the flesh, scoured by machine, partially dried, and then set out to make a firm grain; stuffed with fish oil and tallow on the flesh side, dried, blackened on the grain with dye made from copperas and liquors, and then finished by having all the grease taken off by slickers and brushes.

Bridle-leather is finished same as harness, but is trimmed close.

Russett skirting is bleached after it leaves the scouring-machine, and otherwise finished like harness, only using less grease.

Harness-leather is sold as "long harness," which is the whole side with the belly off, or as "harness backs," in which all the offal is trimmed off. It is exported to Europe to some extent, but mostly in the manufactured state.

The exports of saddlery and harness for the past four years have been in value:

1885	\$178,411	1887	\$193,153
1886	190,891	1888	195,522

CALF-SKINS.

Green calf-skins are washed in a vat, then handled in a solution of lime and water about a week to loosen the hair, then unhaired over the beam, put in a bate of hen manure for about twenty-four hours, after which they are washed out and worked over the beam to clear them, and put in coloring-wheels to set the color; then into tan liquors and handled, from one bate to another, for sixty days, taken

out, shaved, scoured, stuffed with tallow, set out, dried, and whitened, and then blacked on the flesh side with a preparation of vinegar, iron filings, and lampblack. Calf-skins are not exported, but our tanners are making them of such excellent quality that they have almost entirely put a stop to the imports of French and German skins, which until recently came here to the value of \$3,000,000 to \$5,000,000 annually. Ooze calf is tanned like other skins, but prepared so as to show very little grain, and the fleshed side is run over an emery wheel. It is finished in colors. Calf-skins are also tanned in japonica, shaved, colored, and made into gloves.

UPPER-LEATHER.

To make this leather cow-hides of a light average weight are considered preferable. These are washed, fleshed, put in lime five days in vats with rocking-wheels, then unhaired and thrown in a bate of hen manure one day, then wheeled in weak liquors two hours to form the grain. After this they are put in liquors and changed every day, giving stronger liquors, from time to time, for about three months, then skived and split, scoured, stuffed, whitened, and blackened on the flesh side. The split which is taken off is stuffed with tallow and finished on either side, according to the purpose for which it is wanted.

COW-HIDE FANCY LEATHER.

Green cow-hides are tanned and finished into imitation Russia leather for book-binders' use. These hides are tanned the same as for grain leather, but before finishing are split into three parts. The flesh side, after being split, has what is termed a leveling split taken off. This is very thin and used for cheap trunk covering. The remaining portion is rolled on both sides and finished into "flexible soles." The grain side is colored red and finished in imitation Russia leather.

Raw steer or cow hides, tawed in oil, are made into belting, lace-leather, picker and fly-net leather, whips, washers, hame strings, and halters. The process is patented.

FORMULA FOR TANNING AND FINISHING CHICAGO OIL-GRAIN LEATHER FOR BOOTS AND SHOES.

For the best manufacture slaughter hides are necessary. These are soaked in water to remove dirt and salt, carefully fleshed, then limed to remove the hair. After removing the hair they are again soaked in water and put in a bate of pigeon manure and water to extract the lime. After this is effected they are again washed and put in mild liquor, where they remain for something less than two months. When they are thoroughly tanned they are taken out and run through a machine to split to the desired thickness. They are stuffed in a revolving wheel with soft grease, hung up to dry, and when sufficiently dry and firm they are stained with a preparation which in combination with the free tannin in the leather forms a fixed black; then they are pebbled with a roll having cut in it the desired figures. They are then boarded, or softened by rolling between two cork boards. Some preparation is then put on to give the desired finish or gloss to the leather. Then the leather is ready for market.

This leather is run through a machine before it is blacked, and a piece taken off the flesh side, which is known as a split. This is blacked and finished similar to the grain.

The export of buff, grain, and split leather for the past five years has been in value as follows:

1884.....	\$2,062,651	1887.....	\$3,073,833
1885.....	2,578,991	1888.....	2,849,208
1886.....	2,505,456		

PATENT AND ENAMELED LEATHER.

Large, spready green hides are used for this leather. These are soaked, limed, unhaired, fleshed, and bated in the usual manner. On removal from the bate the hides are worked in a hide-mill, through which passes a stream of water; then they are worked over with a bate stone, then placed in a wash-wheel, where they are worked for twenty minutes, and then go into handlers, where they are properly prepared for the reception of the tan-liquor. The hides are tanned in vats having a circular bottom, when a revolving wheel agitates both liquor and hides. When about one-third tanned, a buffing is taken off by hand or machine. They are then put in the belt-knife splitting-machine and divided into three parts. The grain side is enameled in various colors for carriage tops or upholstery purposes. The middle split is used for splatter-boards, or carriage and harness trimmings, and the flesh split for shoes. These splits are tanned in a wheel with gambier liquor, scoured by machinery, stretched on frames, and taken out and dried. Then a mixture of about equal parts of white lead, litharge, and linseed oil, boiled to a sirup, is laid on for a ground work; they are tacked on frames and put in driers face down, then taken out and rubbed with pumice stone, then coated with a mixture of linseed oil, ivory-black, and a little spirits of turpentine, and dried thoroughly after each application except the last one, when they are rubbed down with fine pumice applied with flannel. The sides are finished with a varnish of linseed oil and turpentine in equal parts, copal varnish half the same, and a little asphaltum or ivory-black. This leather is exported to some extent. The exports for the past five years have been:

1884.....	\$116,817	1887.....	\$175,062
1885.....	291,943	1888.....	143,598
1886.....	194,600		

CARRIAGE AND FURNITURE LEATHER.

Hides for this leather are selected specially for being very large and spready; must measure at least 6 feet long by 6 feet wide. Hides are soaked, fleshed, limed, unhaired, and bated in order to free the grain entirely from lime, then laid in sour liquor as whole hides. After a month's tannage they are taken to the splitting-machine and split evenly in two parts. These two parts receive slight further tanning, and are then split again, making four splits altogether, which are known as grain buffing, machine buffed, middle split, junior split. The first or grain split is used for pocket-books, book-binding, and linings for hats, being stained for this purpose. The machine-buffed is employed in carriage-top leather, carriage-cushions, and for furniture upholstery. The third or middle split is for dash-boards and

for patent harness-leather. The junior split is sold to manufacturers of cheap shoes.

Continuation of tannage: After splitting the partly tanned hides they are placed in a weak, fresh-bark liquor for a short time, then laid in a bath of sumac liquor, which softens them and completes the tanning. They are then dried, then dampened and stuffed with tallow and grease and stretched on a frame, to which they are tacked and left to dry. After drying comes softening, then they are retacked on the frame and painted with from five to twelve coats of a black shining mixture, called japan. The leather is dried in steam-ovens after each coating. Patent leather receives more japan than upholstering-leather, which is blacked lightly, then painted with the desired color. The furniture-leather when dried is softened on special machines, hence its pliability. Some leather is boarded after the light japaning is dried, and made to assume an artificial grain. Carriage-top leather is treated this way.

MOROCCO AND KID LEATHER.

These choice fabrics are usually made from foreign raw stock, but Texas and other domestic skins to the extent of about a million skins a year are tanned. This stock is used in the manufacture of shoes.

The skins are put in a "soak" of water two days, then red arsenic is applied for twenty-four hours, until the hair comes off easily over the beam; then they are put in limes two weeks and handled; then pured with dog manure three to eight hours. This is followed by "slating" on the grain and fleshing with knives on the flesh side, after which the skins are put in a mixture of bran and water to clean them ready for tanning in alum, gambier, oil, soap, or sumac, according to the kind of leather to be produced. The skins are shaved on the flesh, after tanning are blacked and finished on the grain side in glazed, pebble, straight grain, brush grain, or brush kid, which are the usual finishes.

There is not much morocco exported, but our manufacturers have improved their product during the past five years, especially in making glazed kid, so that it has almost entirely displaced the imported article, which formerly came in to the amount of about \$5,000,000 worth yearly.

RUSSIA LEATHER.

This leather is made in Newark, N. J., from cow or steer hides, and used for pocket-books, furniture-leather, traveling-bags, etc. The hides are soaked, unhaired and fleshed, then swelled forty-eight hours in a preparation of rye and oat flour, yeast and salt, then placed in a solution of willow and poplar bark, then handled for three weeks in bark liquors, split into two or three parts. After tanning, the hides are cut into sides, washed, dried, and greased with a mixture of birch and seal oil, after which they are dyed in any color.

SHEEP-SKINS.

The wool skins are first washed and then the flesh side is painted with lime, and they are laid away for two or three days, when the wool loosens and is worked off over the beam. The pelts are put in lime-vats from five to fourteen days, according to the kind of leather

to be made. They are scraped on the flesh, washed and put in a drench of bran and rye flour, which ferments and, by chemical action, opens the pores of the skin, takes out the lime, and prepares the pelt for tanning, after which they are "scudded" on the grain side to remove impurities, washed, and "processed" by being put in a solution of salt, sulphuric acid, and water, where they remain three to ten hours. This preserves the skin for an indefinite period, and is called process tanning, and is most generally used with sheep-skins. Another method is to throw the skins from the beam into either bark liquor two weeks, alum one day, or sumac liquor two weeks, where they are tanned, then taken out, hung up to dry, and laid away "in crust," ready to be sorted for the various finishes. A "skiver" is the grain side, a "flesher" the flesh side of a split sheep-skin. These are finished white or in colors, and used in shoe, book-binding, satchel, and pocket-book work.

Sheep-skins are not exported, but, on the other hand, the processed skins, which come in duty free, are imported to the amount of 15,000 to 20,000 dozen a week on an average.

LACE-LEATHER.

This leather is cut in strings, and used for lacing belts, which transmit power; also for whip-lashes, fly-nets, or leather strings. It is usually made from a 30 to 40 pound cow-hide, unhaired with lime, put in a pack of salt and alum a month, then set out on a machine, stuffed with tallow and oil, buffed, and finished. The tanned leather is mostly made in New York and New England, where it is used for factory purposes. When dry hides are used in its manufacture they are soaked, softened in a mill, washed in a wash-mill for a few minutes to remove wrinkles, then split down the back and divided into sides; they are then whitewashed on the hair side by swabbing over them a solution of lime; they are then piled up about two hundred sides high, and remain so ten to twenty days, after which they are unhaired, washed in a revolving wheel, and stuffed with tallow and neat's-foot oil. The proportions of these vary according to temperature; less oil and more tallow are used in summer than in winter. The sides are rolled, shaved on the flesh side, buffed to remove the grain and prevent the lacing from cracking, rubbed with a mixture of lard oil, tallow, and flour, and finished with a glass slicker.

Rawhide lace-leather is made from light cow-hides, which are put in a machine, when oil and tallow are forced into them.

Picker-leather is made from green steer-hides, and tanned and finished the same as lace-leather. It is used for picker-straps in mills.

Walrus leather is used to make wheels on which emery is put to be used in metal-polishers. They are tanned a year in strong oak or japonica liquors, for which they are prepared by an alkali process which removes the oil.

HORSE-HIDES.

These have only been tanned during the past twelve years in this country. Newark, N. J., is the chief seat of the industry. The hides are washed, limed, handled, and unhaired much like other hides intended for upper-leather stock. The sides, after being unhaired, are put in clean water over night, then green-shaved and put in a bate of hen manure four or five days. The bate is worked out;

they are handled in liquor six or seven days, then laid away in ground barks; each layaway extends over about seven weeks. They are tanned six to eight months and are then hung in the air to harden, then dampened and split. The sides are flattened and leveled by the currier. In finishing they are scoured and stuffed, set out, whitened and finished by machines, and blacked with soap blacking or other compounds. Two pieces on the rump of the horse-hide are known as "the shell." After the hide is through the lime this shell is cut out and tanned separately, as it requires different treatment and makes finer leather than the other portion. It is finished on the flesh side, while the rest of the hide is finished on the grain.

ALLIGATOR LEATHER.

Only the belly and sides of the alligator are tanned. The back is scaly, and not fit to be turned into leather. The skins are soaked two to four days in clear, cold water. They are then limed from eight to fourteen days, according to size of skins, after which they are bated with hen manure, made weak, and in this way they are handled ten to fifteen hours, and then cleansed and thrown into a vat of weak hemlock liquor, which is gradually strengthened to 20 degrees in twenty days' time, when they are taken out and hung in the open air. They are softened on the flesh side with a tool made for the purpose, then handled in tan liquor of 10 degrees for six or eight days, taken out, scoured and slickered on both flesh and grain sides and stuffed with tallow and oil, set out, blacked with logwood and copperas on the grain side, glassed, "pasted over the black," glassed again and finished on the grain side with gum tragacanth. When these skins are intended for satchels and pocket-books they are not blacked, but finished natural color or by the application of aniline dyes.

Imitation alligator leather is made from split steer-hides, prepared in the ordinary process by tanning in a drum with gambier or oak tanning liquors, dried and treated with a composition of linseed oil, boiled with litharge or sugar of lead, mixed with naphtha, benzine, or camphine, with sufficient lampblack to give it coloring. Four or five layers of this composition are applied, the hide being dried and pumice-stoned between each operation. The last coat is not smoothed off, but the side is then dampened and passed between rollers or dies, when it is embossed with the desired impression to represent an alligator-hide. Any desired impression for furniture-leather, wall-leathers or hangings can be given by rolls made to produce any figure required.

THE COMPARATIVE COMPOSITION OF AMERICAN AND EUROPEAN BEEF.

By Prof. CHARLES D. WOODS.

A comparison of the analyses of American and European beef, as made by prominent chemists, reveals the fact that there is a very important difference in the composition of this article of food as it is produced on the two continents. The following table, which has been compiled from *Königs Nahrungsmittel*, and from the analyses of Prof. W. O. Atwater, of Wesleyan University, contains the greater part of the reliable chemical investigation of this subject:

Cuts.	Water.	Protein.	Fats.	Ash.
Neck:				
First cut, medium fat, American	60.64	18.26	20.15	0.95
Second cut, medium fat, American	64.48	19.96	14.49	1.07
Third cut, medium fat, American	61.00	20.21	17.74	1.05
Average of three samples	62.04	19.48	17.46	1.02
Total, taking weights into account	61.97	19.25	17.77	1.01
Medium fat, European	70.35	21.38	6.86	1.41
Lean, European	77.50	20.40	0.90	1.20
Hip sirloin:				
Medium fat, American	58.86	17.26	22.94	0.94
Medium fat, American	56.05	16.15	26.90	0.90
Average of two samples	57.46	16.70	24.92	0.92
Very fat, European	63.40	18.80	16.70	1.10
Medium fat, European	71.20	18.19	9.86	0.75
Lean, European	77.40	20.30	1.10	1.20
Small end sirloin:				
Medium fat, American	60.68	16.92	21.53	0.87
Medium fat, European	70.25	23.88	3.85	2.02
Shoulder steak:				
Medium fat, American	65.33	19.40	14.43	0.84
Medium fat, European	70.83	24.64	3.08	1.45
Shoulder clod:				
Medium fat, American	63.97	18.90	16.12	1.01
Medium fat, American	66.61	20.66	11.54	1.19
Average of two samples	65.29	19.78	13.83	1.10
Medium fat, European	75.29	17.33	6.25	1.13
Rump:				
Medium fat, American	40.23	14.65	44.34	0.78
Medium fat, American	56.28	16.07	26.79	0.86
Average of two samples	48.26	15.36	35.56	0.82
Medium fat, European	74.60	19.05	5.42	0.93
Round:				
First cut, medium fat, American	66.04	19.48	13.40	1.03
Second cut, medium fat, American	69.53	20.57	8.57	1.33
Average of two samples	67.79	20.02	10.99	1.20
Total, taking weights into account	66.76	19.71	12.40	1.13
Medium fat, European	70.90	24.21	4.11	0.78
Average of thirty-two samples, medium fat, American	56.58	17.59	24.86	0.97
Whole side:				
Taking weights into account, medium fat, American	52.43	16.44	30.20	0.93
Without kidney fat	54.77	17.20	27.07	0.96
Very fat, average of seven samples, European	55.42	17.12	26.38	1.08
Medium fat, average of twenty-one samples, European	72.25	21.39	5.19	1.17
Lean, average of nine samples, European	76.71	20.61	1.50	1.18

An examination of these figures shows that American beef constantly contains a larger proportion of fat, a slightly smaller proportion of protein, and much less water than similar specimens of European beef. These conclusions are shown more clearly by placing side by side the analyses of similar specimens from the two continents as follows:

Cuts.	Water.	Protein.	Fats.	Ash.
Neck:				
Medium fat, American	61.97	19.25	17.77	1.01
Medium fat, European	70.35	21.38	6.86	1.41
Hip sirloin:				
Medium fat, American	57.46	16.70	24.92	0.92
Medium fat, European	71.20	18.19	9.86	0.75
Small end sirloin:				
Medium fat, American	60.68	16.92	21.53	0.87
Medium fat, European	70.25	23.88	3.85	2.02
Shoulder steak:				
Medium fat, American	65.33	19.40	14.43	0.84
Medium fat, European	70.83	24.64	3.08	1.45
Shoulder clod:				
Medium fat, American	65.29	19.78	13.83	1.10
Medium fat, European	75.29	17.33	6.25	1.13
Rump:				
Medium fat, American	48.26	15.36	35.56	0.82
Medium fat, European	74.60	19.05	5.42	0.93
Round:				
Total, medium fat, American	66.76	19.71	12.40	1.13
Medium fat, European	70.90	24.21	4.11	0.78
Whole side:				
Without kidney fat, American	54.77	17.20	27.07	0.96
Medium fat, average of twenty-one samples, European	72.25	21.39	5.19	1.17

A number of the most conspicuous examples of this difference have been shown on the chart which forms a part of the exhibit of animal products.

A comparison of the fuel or heat-producing value of such similar specimens of American and European beef makes the difference even more marked than would be suspected by a casual study of the figures reached by the analyses referred to above. Thus the fuel value of the similar cuts has been calculated as follows:

	Calories in 1 kilo.
Neck : Medium fat, American.....	2,442
Medium fat, European.....	1,515
Hip sirloin : Medium fat, American.....	3,002
Medium fat, European.....	1,623
Small end sirloin: Medium fat, American.....	2,696
Medium fat, European.....	1,337
Shoulder steak: Medium fat, American.....	2,137
Medium fat, European.....	1,297
Shoulder clod: Medium fat, American.....	2,097
Medium fat, European.....	1,292
Rump: Medium fat, American.....	3,938
Medium fat, European.....	1,285

The fuel value of American beef is, in round numbers, from one and one-half to three times that of European beef as shown by these analyses.

The importance of these facts is still more apparent when we consider that the analyses of the average dietaries of European workmen show that these are poor in the very principle which is most abundant in American beef. In other words, it is well established that an increase in the amount of fats eaten by the laboring classes of Europe is needed to make their ration complete and to give them the strength needed for arduous labor. The American beef, therefore, not only supplies to the natives of Europe, a cheap, wholesome, and in every way excellent article of food, but it gives the chemical principles which are usually deficient in the food as now supplied, and for this reason, if no other, it should become an important article of commerce.

OUTBREAKS OF SOUTHERN CATTLE FEVER IN MARYLAND.

Hon. NORMAN J. COLMAN,
Commissioner of Agriculture:

SIR : The recent outbreaks of Texas or Southern cattle fever among cattle in Carroll County, Md., was of such dimensions, and presented such characteristic features, as to require a somewhat detailed statement.

On the 6th day of August, 1888, Darius Devilbiss, a cattle dealer of Unionville, Carroll County, Md., bought, at the request of his patrons, 98 head of cattle in the Chicago stock-yards. They were purchased from commission merchants Cassell & Wigelsworth, through the intervention of Mr. J. Cudney, an agent. They were bought in small lots as follows: 26, 17, 3, 2, 16, 1, 27, 4, 2, and were composed of cattle which may have been in the yards and shifted around for several days.

These cattle were loaded into four cars and shipped via the Pittsburgh and Fort Wayne Railroad eastward. The cars are said to have been cleaned, before being used, by the railroad company. They were bedded with sand. Arriving on August 8, at East Liberty, near Pittsburgh, they were unloaded into the yards there, fed, watered, and reloaded into other cars bedded with tan-bark. From there they were sent to the Calverton stock-yards, near Baltimore, via the Pennsylvania route. They arrived at Calverton on August 9, where they were unloaded. On the following day they were driven along the Liberty pike to a point some 17 miles distant from Calverton, and then pastured at Mr. Hoofmeister's. On the succeeding day Mr. Devilbiss selected 72 head and drove them along the Liberty road until he reached the vicinity of Unionville in the evening. Here he pastured the cattle on the farm of Mr. George D. Norris.

The 22 head left at Mr. Hoofmeister's were said to be "mostly fat cattle," and on the 15th of August were returned to Calverton, and on the 16th they were sold on the market to Henry Eckert, a commission merchant of Baltimore.

On Monday, the 13th day of August, the greater part of the cattle were sold. A few were sold the following day and a few remained on the place until the 17th, and some even later, as will be seen hereafter. They were sold to sixteen different farmers, as follows: Isaiah Nussbaum, 12 head; John Gaither, 4 head; David Dudderor, 4 head; William Baker, 1 animal; Charles Poole, 7 head; William Boland, 7 head; Andrew Alexander, 4 head; John Roop, 5 head; George Devilbiss, 1 animal; C. M. Thomas, 10 head; James Etzlur, 1 animal; Samuel Kiefers 9 head; Darius Devilbiss retained 4 head. These farmers live at some distance from each other, but, with one exception, in the vicinity of Unionville. Many of them had previously instructed the dealer to buy cattle for them and had told him what kind they wanted.

On August 23 the first death among these cattle took place. From this time on until September 9 they continually dropped off, until at that date but eleven invalid and convalescent animals were left. Among these were but one or two which were said not to have been sick. Besides the loss of the new cattle there was a loss of native cattle at this time, which has been ascribed to the same disease. These losses happened on the following farms, viz: Henry Dorsey, 1; James Etzlur, 1; W. H. Baker, 1; George D. Norris, 3; John I. Barton, 1; Mr. Long, 1. Of these the cow belonging to Henry Dorsey apparently died from other causes, leaving 7 native animals, all cows, which seem to have died from the fever.

These 7 natives with the 60 strange cattle make a total of 67 head which died at that time. Whether or not they all died from the same causes may be inferred from the following histories:

On Monday, the 13th of August, Isaiah Nussbaum bought 12 steers, which he removed to his farm. On Tuesday of the week following he first noticed that his cattle stood around and did not feed. On Thursday, August 23, he lost his first steer. Another died on the following Monday, August 27, and 4 others on the 28th. Between this date and the 6th of September 4 others died. Of the original 12 but 1 convalescent animal was left at the time of my visit, September 8. Mr. Nussbaum's description of the sickness and death of these animals was similar to other descriptions, and tallies well with the general symptoms of Texas fever. As all of the farmers gave these symptoms alike I will not narrate them in each instance, but place them under one paragraph. Mr. Nussbaum's steers had been with his native stock, but after the first death he separated them. None of his other cattle had shown signs of illness.

John Gaither bought 3 heifers and 1 bull on August 13. He put them with his native cattle on this date where they remained until the 27th, when he separated them. The bull died August 25 and a heifer on September 2. Of the 2 remaining (September 5), 1 was convalescent and the other had apparently not been sick. None of the other cattle had been sick since the strange cattle were bought.

David Dudderer bought 4 head on the 13th or 14th of August and put them with his other cattle. He lost his first animal on August 25, 1 on the 28th, another on the 30th, and the fourth and last on the 1st of September. None of the other cattle have since shown any symptoms of the disease.

On August 13 Mr. Charles Poole bought 7 steers. He lost 1 on August 26, 1 on the 28th, 1 on the 29th, 1 on the 2d of September, and 1 on the 9th. They were put with his home stock but removed when they were first noticed sick. The remaining 2 were sick, but on October 9, though living, were very weak and convalescing. None of his home stock were noticed to be sick with the fever.

On August 13 Mr. William Boland bought 7 steers. They died in the following order: One each on the 25th, 26th, 27th, and 31st of August, and 3 on the 28th. Two other cattle had been exposed but have not shown symptoms of the disease.

Mr. Andrew Alexander bought 4 steers on the 13th of August. He put them with the native stock, but none of these have since been sick. Of the former the first died August 23 or 24; the second August 28, the third August 30, and the fourth September 1.

Mr. Samuel Kiefers bought 9 steers on August 24. The first of these died on August 27, the second, third, and fourth on the 28th; 1 each on the 29th, 30th, and 31st, and 1 on the 4th of September.

ber. The steer now living was the first to be taken sick, but though very weak, was, on the 8th of September, apparently convalescing. These cattle were at first placed with others, but have since been separated. No others were noticed to be sick.

Mr. C. M. Thomas bought 10 steers on the 14th of August. Of these he lost 7, 1 on the 26th, 2 on the 27th, and 4 on the 28th. He has 3 left, 1 of which, up to the 7th of September, had not been sick, the other 2 at that date being convalescent. He did not place these cattle with others until a week after. He then united them to his herd for a week when he separated them. No others were taken sick up to September 7.

Mr. George Gaither bought 2 heifers on the 14th of August. One died on August 28 and the other was still living on September 8, but had been very sick. These animals had been with other cattle, but were separated after one died. The heifer had recently been allowed to join cattle. None of the latter had been sick up to September 8.

Mr. George Devilbiss bought 1 animal on August 13, and it died on the 30th.

Mr. John Roop bought 5 head on August 13. Three of these he sold, 1 to Sharets & Devilbiss, which died on August 29; 1 sold to Edward Carlisle died on August 28; and 1 he butchered August 20. The fifth animal died on his hands on August 25.

Mr. Charles Zumbrun bought 1 animal on August 17, and it died on the 27.

Mr. Darius Devilbiss retained 4 head; 2 of these were slaughtered and 2 heifers died. The first animal died on August 27, and the second on September 3. These were kept on the same pasture after their arrival in Unionville.

Mr. James Etzlur bought 1 steer on August 18, and it died on the 27th. This steer was added to other cattle. The native cow that fought with it when it first arrived died on September 3. He lost no others. The cow had no other source of infection. From a description of her symptoms I was forced to conclude that she died from Texas fever.

Mr. William Baker bought a heifer on August 13, and it died on the 27th. He also bought through Mr. Devilbiss a native cow belonging to Mr. Duvall, of Unionville. This cow pastured in a field adjoining the roadside, but on the opposite side of the road where the strange cattle passed and repassed when being weighed. She was driven with the red heifer to Mr. Baker's farm. After arriving there on the 13th she fell off in milk. On the 22nd of August she died of the same disease as the heifer, as near as Mr. Baker could judge. The gall-bladder was much enlarged.

Mr. George D. Norris owned the farm on which the introduced herd was pastured. His cattle did not mingle with the others, as they were separated by a fence. Though they usually drunk in the trough above, near by the barn, they could have drunk from the brook in the pasture below. This brook did not properly run through the pasture in which Mr. Norris kept his cows, but two panels of fence, about 20 feet, had been set over so as to include a portion of it. The water ran from the pasture where the 72 strange cattle were kept towards the pasture where the native cows were confined. The native cows were kept on the hill during the forenoon; at noon they drank at the barn and were driven into the lower pasture. They could have touched noses over the fence. The lower watering place and the actual contact of noses were the only chances that I could learn of for Mr. Norris' cattle to contract the disease. Nevertheless

3 of them died, 1 on August 23, after a sickness of 3 days, another on the 30th, a week later, after being apparently sick 3 days; the third animal died on September 4, late at night, of the same symptoms. The *post-mortem* examination of the third cow proved beyond doubt that the animal died of Southern cattle fever. The others, up to September 8, continued well.

Messrs. Long and Boston each lost a native cow, 1 on August 25, and 1 on August 26. These cows have essentially the same history. They stray on the commons, and from their bells are known as the bell team. They are known to have grazed along the Liberty road on the same day after the Devilbiss herd of 72 cattle passed, and it has been said that they mixed with this herd for a distance.

Mr. Henry Dorsey lost a cow about that time, which a day or two before had passed over a piece of the same road, but as this cow was ill before the 11th of August, and died in a very few days after, no reliance can be placed on the rumor that she died of Texas fever.

In regard to *ante-mortem* symptoms of these animals there is not much to be said. As in other outbreaks, the attack is so virulent and quickly over after it is first noticed that one living at a distance has scarcely time to arrive on the ground before the last animal has died.

So far as I could learn none of the farmers had reason to suspect the presence of disease in their cattle until the 21st or 22d of August, and but one at that time. Mr. Isaiah Nussbaum noticed at this date that his cattle were not feeding as they should. The invariable testimony of the remaining farmers is that the cattle were well up to within two days of their death. One or two may have noticed it as early as three days. At this period the cattle were not feeding; their ears lopped; their coats were rough and staring; their backs were arched and flanks tucked up, and their heads hung, and were slightly extended. If aroused they moved off to browse a little, only to stop shortly after. One or two of the farmers noticed that their horns were hot at this stage. Later some said their horns became cold. On the day of, and on the day preceding, their deaths, they manifested various symptoms. Some stood with their heads pressed against some firm object; some supported themselves in their weakness by leaning against a wall or fence; the gait of all became weak and tottering; some manifested thirst; a few would try to eat even to the time of death; if there were a number together they crowded each other; others, when approached while standing still, seemed combative and either did or tried to attack the person approaching; some died in or near water; others died with their horns interlocked with the fences.

It was my fortune to be able to take the temperature of a few. The temperature of the last of Mr. Charles Poole's steers that died was 106° F., taken about two hours before death. The temperature of the third cow that died of Mr. George Norris' herd, was 103° F., taken about noon September 4, but at 2 o'clock p. m. the temperature was 106° F. The cow died that night. The temperature of Mr. George Gaither's remaining heifer was 106° F., taken about 6 p. m., September 5. On the following day it had fallen to 103° F., and the animal appeared much better. This animal was taken sick Monday evening. The temperatures of 3 of Mr. William Boland's cattle, taken on the 28th of August by Dr. A. M. Farrington, were 105°, 106°, and 107° F. Two of these died that evening and the third on August 31.

Few of the farmers noted any particulars of the *post-mortem* condition of the viscera. Those that did were struck with the engorged "blackberry-jam" appearance of the milt or spleen, the yellowness of the fat in some cases, and some noticed the urinary bladder dilated by the dark, red-colored fluid which it held. Some noticed the animals urinating "blood" before death. These *post-mortem* observations were also noticed in nearly every case of the 7 natives which died.

TABLE I.

Names.	Cattle bought.	Native.	August.									September.				Died.	Killed.	Still left.	Total.
			22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	1.	2.	3.					4.
Isaiah Nussbaum.....	12			1			1	4	...	(*)	(*)	(*)	(*)	...	†1	11	...	1	12
John Gaither.....	4				1								1	...		2	...	2	4
David Dudderer.....	4				1			1		1		1	...			4	...		4
William Baker.....	1	1	†1				1									2	...		2
Charles Poole.....	7				1			1	1				1	...	\$1	5	...	2	7
William Boland.....	7				1	1	1	3		1		1				7	...		7
Andrew Alexander.....	4				1			1		1		1				4	...		4
John Roop.....	5				1		1	2								4	1	...	5
George Devilbiss.....	1									1						1	...		1
C. M. Thomas.....	10						1	2	4							7	...	3	10
George Gaither.....	2								1							1	...	1	2
Charles Zumbrumm.....	1							1								1	...		1
James Etzlur.....	1	1						1						†1		2	...		2
Darius Devilbiss.....	4							1						1		2	2	...	4
Samuel Kiefer.....	9							1	3	1	1	1				8		1	9
George Norris.....		4		†1							†1				†1	†1	4	...	4
Long & Boston.....		2				†1	†1									2	...		2
Total	72	8	1	2	1	6	3	10	20	2	5	2	2	2	2	3	67	3	80

* Four others.
† September 6.
‡ Native cattle.

§ September 9.
|| Mr. Norris lost 2 other head of cattle.
¶ September 11.

POST-MORTEM EXAMINATIONS.

The following notes are from the *post-mortem* examinations of the 5 cattle which died at such a favorable time that they could be examined before decomposition had destroyed all normal and pathological appearances. The examination of the first animal was made by Dr. A. M. Farrington, Assistant Chief of the Bureau. The subsequent examinations were made by myself.

Steer No. 2.—This animal was the last of Mr. William Boland's 7 steers. It died on the night of August 30. As it was 3 o'clock the following afternoon before the examination was held, and as the animal had been skinned at 9 o'clock in the morning, decomposition had set in and many particulars were obscured. The blood was black and clotted in both sides of the heart. A portion of these clots were washed white. There was an excess of dark-colored fluid in the abdominal cavity. A small perforation of the intestines in the right hypochondriac region was observed, but it may have been due to the violent handling of the carcass. The thoracic walls near the attachment of the diaphragm showed signs of inflammation. The urine was dark red and considerable in quantity. The mucous membrane of the bladder showed a few extravasations of blood, most of them situated on the prominent ridges. The kidneys were decomposed in their cortical portion. The spleen had so far decomposed that gas escaped from it with a perceptible sound when cut into. The fourth stomach or abomasum had two patches somewhat reddened, indicating a superficial inflammation of no great extent. The intestines were dotted with dark red spots, about one-fifth of an inch in diameter. These were not of the nature of petechiæ. The mucous membranes were bright red on the prominences, in scattered patches, but more especially in the lower part of the jejunum and beginning of the ileum. The serous membranes were fairly well preserved except in the vicinity of the duodenum, where it tore easily. The duodenum was decomposed. The liver was too far decomposed to be examined. The lungs were normal.

Steer No. 3.—This animal died on Mr. Charles Poole's farm on September 2, about noon. The examination was undertaken about two hours later. Its temperature about one hour and a half before dying was 106°, taken at two separate trials. Its eyes were inflamed and whitened; after death their interior appeared opaque and yellowish. When first seen the animal was standing in the pasture; it had previously been lying down and had paroxysmal attacks, from one of which it afterward died. The animal, though the flanks were tucked up, was moderately fat. The fat had an orange-yellow tinge. The spleen was enlarged and tumid with blood of black-red color, and of blackberry-jam consistency. The liver had a heavy waxy feel, and a decidedly yellowish color. The gall-bladder was normal in size and full of bile. The kidneys were overlooked. The urine was very high-colored but not bloody or wine-colored. The abomasum had some slightly reddened patches on the mucous coat; no ulcerations were seen. The rumen was impacted. The small intestines contained occasional dark spots, about as large as the head of a lead pencil. The prominence of some portions of the villous surface were injected with blood, so that a reddened appearance was presented. The patches of inflammation were decidedly more abundant in the ileum than in the jejunum. The duodenum was blackened on its villous surface, and a slight decomposition had set in. The odor was fetid. The lungs contained some blood spots, which appeared to have been made about the time of death. Some scattered lobules were collapsed. One side was emphysematous. The thoracic walls near the diaphragm were roughened as if from inflammation as in case No. 2. The heart showed blood-red spots which followed the direction of the muscles beneath the pericardium. These were more abundant on the left side toward the apex. Washed clots stained with yellow were found in each half. The surface of the lungs was stained yellow. The fauces were dark and inflamed, but this inflammation did not extend into the trachea.

Heifer No. 4.—The fourth animal examined belonged to Mr. Darius Devilbiss, and died the night before September 4, the day of examination, in the field into which the 72 head of cattle were first driven. The examination took place about 11 o'clock, but the morning had been rainy and cold so that decomposition had not set in to any great extent. She was one of the original drove, and like others of that lot carried a large number of ticks.

The abdominal cavity contained rather more than a normal amount of serous fluid. This fluid was rather dark. One portion of the mesentery appeared as though there were some peritonitis present. The fat was of an orange-yellow color. The spleen was enlarged, but the color was nearly normal. The liver had a yellowish cast; it was beginning to decompose on its concave surface, and more especially towards that part which was next the duodenum. The gall-bladder was tumid and somewhat larger than normal. The left kidney was very dark colored (from decomposition) on the outside, but apparently sound in the central portion. The bladder contained about a gallon of claret-colored urine. The omasum or manifolds was impacted. The abomasum or fourth stomach was normal. The left lung was normally contracted, but the right was full and spongy. It presented a yellowish tinge on section, but looked bright. The heart presented bright red spots underneath the epicardial serous membrane. These spots had their longest dimension in the direction of the muscles, and were more abundant in the left portion near the apex. There were clots in each side of the heart, and that on the left side was slightly washed. The pericardial sac contained an excess of reddish-tinged fluid. The fauces presented but little inflammation.

Cow No. 5.—This animal was a native cow, and the third that had died of similar symptoms on George Norris' farm. The only possible contact of Mr. Norris' cattle with the infected herd was either by the brook or across the fence as elsewhere described. The animal died on the night of September 4. Her temperature, taken the forenoon before, was 103° F., but in the afternoon it was 106° F. This cow, like the other two, had the habit, during the last days of sickness, of pressing her head against the wall at times; she was very weak and showed some pain when lying down. The examination was made about 9 o'clock a. m. The carcass was but little if any decomposed. The spleen was enlarged, and had the blackberry-jam-like appearance. This spleen showed a marbled appearance of the surface, with the mottling varying between the normal gray appearance and that due to the blood showing through the serous membrane. The liver seemed slightly enlarged and with a yellowish tinge, but this was not as marked as in No. 4. The gall-bladder and surrounding tissues were stained with bile. The fat was of the orange-yellow tinge. The kidneys were enlarged and had acute congestion. The bladder was very full, over one gallon of dark claret-colored fluid being present.

The intestines were more inflamed than any previous case. The fourth stomach had all its mucous coat congested. The animal had been drenched the day before with glauber salts, and this may have given rise to this appearance. The third

stomach or manifolds were slightly impacted. The duodenum was black in the mucous coat. The small intestine had numerous small black spots along its length. The villous coat was reddened and in some places, more especially the ileum, blackened by inflammation. There had been some peritonitis, indicated by the presence of considerable serum in the abdominal cavity. The lungs were normal; the extreme tip of the right was affected with worms, *Strongylus* and *micrurus*. The thoracic walls were slightly inflamed in the posterior portion adjoining the diaphragm; at one or two points near the diaphragm they were adherent. The fauces were normal.

The foregoing presents as nearly as may be the facts in connection with this outbreak. They present also to us what is known of the the primary infection, the incubation, the duration, and the final cessation of the disease.

Of the different stages of the disease that which we have the least information of, viz., the stage of infection, is the most important, and unfortunately is the one which is the least capable of elucidation. The history of the herd after leaving Chicago is comparatively clear, but before that time but little is absolutely certain to us. As the herd, as stated, was made up of at least nine different lots when purchased in Chicago, it is evident that those cattle may have come from as many different localities as there were lots. There are a few facts hitherto unmentioned, which will give us a better idea of where these animals may have originated. In the first place they were a lot of stockers or cattle to be resold for fattening purposes; only 26 head were sufficiently well fed to be sold to the Baltimore abattoirs. Further, they were a lot of mixed cattle, 1 bull, 64 steers, and 8 heifers. Of those that came under my observation, the steers were in medium condition, and with the exception of one set that bore traces of Hereford blood, were ordinary cattle. The heifers were young, but were not grade stock. The horns of the three and four year old steers were as a rule long and thin, but not Texan, as, instead of branching laterally, they were more erect and narrow. One steer only was branded on the thigh. I did not see the brand. Several of the steers were branded on the horns. The brand was D. F., burnt on each horn. I saw neither ear nor dewlap marks. The cattle were covered with young, well-grown cattle-ticks. Of these signs that of the marking by branding the horns seems to be the most characteristic, for this mode of marking is not a custom of the range country, but of some restricted locality in the more eastern States. The presence of the cattle-ticks indicate that these animals came from the latitude of Washington and St. Louis, or further south, for they are not said to be abundant north of this latitude.

With but two exceptions, a heifer bought by Mr. John Gaither and a steer bought by Mr. C. M. Thomas, all the animals were sick. This might indicate that none had hitherto had the disease, as one attack is supposed to render an animal immune from further attacks. Mr. Gaither's animal was a young heifer, and it may have been that she had a slight attack which passed unnoticed. Though there is uncertainty as to any of the animals coming from the country permanently infected, the evidence obtained from a study of the outbreak tends to show that they did not.

The history of the herd while at Chicago, prior to the 6th of August, when it was made up, is as indefinite as the previous history. The only facts that could be learned were that these animals had been shifted around the yards through some days. But this indefiniteness is of itself sufficient to afford a strong suspicion, when we consider the after history, that these cattle may have been infected about that

time. Judging from a proclamation of the governor of Illinois, issued to take effect the 25th of September, there had been, previous to the latter date, no effective means taken to insure that cattle susceptible to the Southern cattle fever should not come in contact either with affected Southern cattle or with their trail. The shifting of these cattle from pen to pen increased the chances of infection from Southern cattle, thousands of which were weekly passing through the yards.*

After the 6th of August all the cattle passed through the same conditions, but to what extent they were exposed to any contagion en route from the Chicago to the Calverton drove-yards can not be learned. Their chances of infection ceased after leaving the Calverton yards.

As nearly all died about the same time, it may be urged that they must have contracted the disease after being collected into one herd, for it is generally believed that one native cow can not take it from another. The subsequent history of the outbreak shows, however, that these sick animals did give the disease to at least eight native cows, under conditions far more unfavorable than those presented by the animals transported and driven together in a close drove. There is no reason to suppose, therefore, that this disease may not have spread while the cattle were en route.

The time, then, during which I consider that the herd was exposed was about a week, or from a day or two before the 6th until the 10th of August. It should be borne in mind, however, that, though there were increased probabilities of infection at certain points, it would be unjust to say that it did occur in any particular place until the weight of the circumstantial evidence bears out the assertion. Also that a single hour's exposure to the trail of infected cattle at any point along the route would have been sufficient to infect the herd. From the time that the animals were exposed until they began to show signs of the disease was the period in which the disease was incubating or developing. Each of the farmers stated that they did not notice that the cattle were sick until two or three days before they died. This stage extended from the 10th to the 20th, when one or two were noticed to be ill, or until the 24th, when more showed symptoms. The duration of this stage was therefore about two weeks. It covered a part or all of the time that the cattle were in transit from Chicago to Calverton, and the time until after the cattle were distributed to the farms on which they died. During the first part of this period the cattle were necessarily restless, excited, and over-heated, on account of the transportation. During the latter part they were only subject to such disturbances as would accompany their becoming accustomed to a new place.

The stage of manifest fever succeeded, and although it occupied but two or three days for each animal, yet for the herd collectively it extended from the 21st of August to the 4th of September, and for the herd can be considered as embracing about a week and a half. For about 70 per cent. of those that died this stage was comprised within a week.

* The already oft-repeated experiment of allowing native cattle to live on the trail of Texas cattle, which was initiated on the 3d of July in the Chicago stock-yards, by placing five cows in pens frequented by Texas cattle, with the resulting illness of all and the death of four from the Southern cattle fever, is sufficient of itself to indicate that infection in these yards was quite possible.

This stage was abruptly terminated by death in 85 per cent. of the original herd of cattle taken to Unionville—not an extremely high percentage of fatality to be caused by this disease, but very high when compared with that caused by other contagious diseases of cattle in this country. The remaining 15 per cent. were, on the 9th day of September, convalescing, but the most of them appeared to have been very sick and as though they had small chances of recovering. The table (I) shows that this stage had reached its maximum on the 28th of August and fell rapidly off, there being after this but two deaths a day, excepting the 30th, when there were five. This scattering of the fatality seems to indicate that these animals were perhaps better able to resist the disease than those stricken down earlier. In the cases of introduced cattle that I was able to examine there seemed to be a more chronic form of the disease than existed in the single native cow that I examined; that is, the animals dying in these later days had passed through the acute stages and were entering into the chronic stages of the disease.

These stages of the disease may be roughly reviewed in the following table, which considers the disease of the herd and not of individuals:

TABLE II.

Stage of infection, one week.
Stage of incubation, two weeks,
Stage of fever, two weeks.

For the individuals affected, the following table will more nearly represent the truth:

TABLE III.

Exposed to infection, part or all of seven days.
Stage of incubation, thirteen to twenty-five days.
Stage of fever, two to three days.

As the exact date of exposure can not be learned, these dates are only approximate. It is not likely that all of the cattle could have had the disease before being brought together in Chicago; so that it is fair to assume that the whole course of the outbreak was comprised within from four to five weeks. The death of the animals occurring as early as fifteen days, and the destruction of the bulk of the herd within twenty days, after the herd was made up, indicate that the outbreak was one of the virulent type. In this outbreak the period of thirteen to twenty days is necessarily as long as the period of incubation of the greater proportion of the diseased cattle, for they were collected on the 6th of August, separated on the 13th, and had nearly all died by the 28th. The period of exposure for at least part of the animals, if not all, supposing that all had not been infected before the herd was made up, was from the 6th to the 13th of August, the dates between which all of these animals were more or less intermingled, or seven days. The total duration of the outbreak was about five weeks, or thirty-five days.

THE DISEASE AMONG NATIVE CATTLE.

At the time of this outbreak eight native cows died under such circumstances as to justify the assertion that they died of the Southern cattle fever. They belonged to William Baker, James Etzler, George Norris, and Long & Boston. These animals were infected under a

variety of circumstances, but all died with the same symptoms, and in cases that were observed showed characteristic lesions of the disease.

Of these animals those belonging to Long & Boston were the first exposed to the disease. As narrated above, they were not only pastured along the road on the same afternoon that the herd had been driven to Unionville, but had probably mixed with the herd for some distance. About this latter point there seems to be a difference of opinion. The two cattle were known as the "bell team," and pastured on the commons. They were first exposed on the 11th of August. They may have pastured along the road after that date. They also may have had communication with Samuel Kiefer's cattle on an adjoining farm. Each was noticed to be sick about two days before death, and on opening the bladders they were found to be filled with red fluid. Such symptoms as could be obtained corresponded with those passed through by other animals stricken with the disease. The first one died on the 25th and the second on the 26th of August. From the first opportunity of exposure until death but fourteen days had elapsed. The animals in each case showed their illness on the day before death, and therefore the incubative stage could have been but twelve days at the outside for the first, and thirteen for the second. The first stage of infection lasted in either case but a few hours. These were the first native cows exposed.

The next native cows exposed belonged to Mr. George Norris and were pastured in an adjoining pasture. A few feet of a brook that ran through the pasture confining the natives were included in their pasture. They were first exposed on the 11th of August, when the infected herd was admitted. The first sickened on the 23d and died on the 23d; the second died on the 29th, being ill but two days; the third died on the 4th of September, having been ill but one day, and the fourth on the 11th. Two others are said to have died, but of these I could get no positive data. Each having died at such regular intervals caused Mr. Norris to think that they had been catching the disease from each other.* The first could not have had a longer incubative stage than from the 11th to the 23d of August, or eleven days.† The second may have had an incubative stage of nineteen days, the third twenty-four days, and the fourth thirty-one days. The incubative stage of these latter animals will rest more in doubt, for they may not have contracted the disease as early as the first. The stage of fever in each case was about two days. These animals, as described in the historical evidence, died of Southern cattle fever. The *post-mortem* examination of the third that died fully confirmed the diagnosis.

Mr. William Baker drove home on August 13 an infected heifer and a native cow bought in the village. The cow fell off in milk after arriving, but regained it subsequently. She died on the 22d of August, six days before the heifer. Further than external symptoms there was little to be relied upon. It was said that they acted alike, and that the cow had a large gall-bladder. The date of incubation in this case, if the cow died of the disease, was but nine days at the outside. If we allow two days as the stage of fever then it

* The following data are vitiated by the presence of the 26 head bought in Chicago and placed in the meadows June 26. See history at end of article.

† In truth, this period was nearer ten full days than eleven, for the animals did not arrive until the evening of the 11th, and the 22d and 23d should be called days of the stage of fever.

was but eight days. This time is the shortest stage of incubation of any in the lot; in fact, it is so short that unless further experience demonstrates that such a short stage of incubation may be passed through at times, we may suspect that another disease may have killed the cow.

The steer that infected the cow on Mr. James Etlzur's place was taken there on the 18th of August. There were other cows on the place, but this one that died was observed to have actual contact in fighting with the strange steer. The cow died on the 3d of September, after an incubative stage of fourteen days at the outside, allowing two days for the fever.

The following table is compiled to present these facts more clearly and concisely:

TABLE IV.

Names.	Cows.	First exposed.	Died.	Period of incubation.	Duration of fever.
				<i>Days.</i>	
Long	1	Aug. 11	Aug. 26	14	} Each was noticed to be sick about two days.
Boston	1	Aug. 11	Aug. 25	13	
Norris	1	Aug. 11	Aug. 23	11	
Do.	2	Aug. 11	Aug. 30	19	
Do.	3	Aug. 11	Sept. 4	24	
Baker	1	Aug. 18	Aug. 22	8	
Etlzur	1	Aug. 18	Sept. 30	14	

A comparison of the data of Table III with those of Table IV affords much confirmative evidence. In the outbreak amongst the introduced cattle the stage of infection was said to be during a week. The native cows stricken seem to show, from the variety of methods of exposure, that the time of infection is not necessarily long. It may be but an hour and include a longer time. In the case of the Long & Boston cows, if actual contact was necessary, this stage lasted but a few minutes; if pasturing along the road was the means of infecting the cattle then there need not necessarily have been even a few hours. The other cows were exposed through a longer period. The two belonging to Baker and Etlzur had not only opportunity of actual contact but of feeding in the same pasture with the diseased animals. The other three cows had less opportunity of contact, and none of feeding in same pasture, and were thought to have had little opportunity of being infected by drinking. They were infected, however, and it must be ascribed either to actual contact over the fence or to their drinking the same water. Mr. Etlzur's steer, which was not bought until the 18th of August, showed that the disease in this case was communicable from it to the cow fully a week after the other cows had been infected, or *that the time during which the herd was capable of infecting other cattle was at least eight days*. In all the cases of infection the infecting cattle are shown by the history to have been recently excited and heated before the exposure of the native cows. The only one of Etlzur's cattle that was stricken was the cow that fought with the steer immediately after its arrival and had actual contact.

There are in the infection of the natives these different methods of infection placed before us, viz., through actual contact, through pasturage, and through the drinking water. Actual contact may have been denied to none. The Long & Boston bell team offers the

only possible exception. Contact through pasturage was denied to the Norris cattle. Contact through drinking water was probably denied to the bell team. Those native cattle which were known to have most communication with the infected cattle are those that died.

The stage of incubation in the outbreak among the native cattle occupied about the same length of time as in the infecting herd. With some of the animals the time seems to have been shorter among the natives, indicating a greater virulence of the disease, but this may simply have been due to the fact that the natives were milch cows and less able to resist the contagion. Mr. Norris' first cow that died offers the shortest time that we are entirely certain of. The eight days' incubation of Mr. Baker's cow is the shortest, but showing an illness on the first night that it is driven home vitiates the accuracy of the statement. I think, however, that the cow died of Southern cattle fever, and this time is the shortest of which there is record. Excepting the last three of Mr. Norris' cattle, which died in nineteen, twenty-four, and thirty-one days, respectively, all died within two weeks after the first possible exposure. The two exceptions may have died within two weeks after exposure, as there is no certainty when they were first infected. It must be remembered that the stages of incubation given in Table IV not only include the time of stage of infection, but also the time of the stage of fever. If we allow one day only for the stage of infection and two days for the stage of fever there are left eight, ten, eleven, sixteen, twenty-three, and thirty days, excluding Mr. Baker's cow, which had five or six days. The three cows belonging to Mr. Norris, which died in nineteen, twenty-four, and thirty-one days after infection, offer to us the suggestion that they may have contracted the disease from each other in turn, as Mr. Norris himself thought. The stage of fever in all these cattle occupied about two days each.

In conclusion, I would point out that the facilities for obtaining the facts in the above outbreak, as well as its peculiar characters, make the history of this outbreak an important one in the clinical history of the disease. In comparing this outbreak with others it will be found that there are but few which record such a short period of incubation, especially among the natives, which have been more virulent, and show a clearer record in regard to the infection and disease among natives.

In regard to the outbreak of disease among cattle near Westminster, Carroll County, Md., I have the honor to report as follows:

Mr. Harry Cover, of Westminster, bought 105 head of cattle in Chicago on the 10th of August, 1888. The herd was composed of numerous small lots. These cattle were loaded on the 13th of August and shipped to Taneytown, Md., where they arrived on the 17th. They were unloaded and fed at East Liberty, Pa., on the 15th. There were but few marks designating the original pastures of these cattle. The ear tags of a few showed that they came from Missouri.

On the 18th of August the cattle were distributed to these farmers: Samuel Cover, 53 head; B. F. Shryver, 30; Edward Matthias, 5; Allie Shafer, 6; Fred Bachman, 1; Mr. Myers, 10.

Of Mr. Samuel Cover's herd, 8 head died and 4 others were taken ill. One died on the 25th of August; 3 on the 26th, 2 on the 29th, 1 on the 31st of August, and 1 on the 1st of September. Mr. B. F. Shryver lost 1 on the 25th of August. There was 1 other animal which either strayed away or died. Mr. Edward Matthias lost 1 on the 26th of August. This makes a total of 10 head which died.

The accounts of the symptoms were meager, but such as I could get were those of Southern cattle fever.

In this outbreak there was an incubation period of about fourteen days, allowing two days for the stage of fever, and supposing that they may have been infected in the Chicago stock-yards. The fever was completed in twenty-two days from the time that the cattle left Chicago. No natives were reported sick. There being 105 head involved, and but 10 died, shows that the disease did not spread extensively in the herd. As 4 others only were reported sick, it may have been that these 14 belonged to one of the smaller bunches that composed the large herd and were alone exposed in some of the cattle-pens at the Chicago stock-yards.

The coincidence in dates between this outbreak and that occurring amongst the cattle bought at the same yards but little earlier (the 6th of August) by Mr. Darius Devilbiss and taken to Unionville in Carroll County is worthy of attention. In each outbreak the cattle began dying about the same date, and the maximum of deaths on a given date was noticed in each instance about the same time. The stage of incubation in each case was strikingly alike. This outbreak would confirm one in the belief that the Unionville outbreak originated in Chicago.

The following are the facts, as near as I could learn them, regarding an outbreak of disease among cattle near Union Bridge, Md. The information was kindly communicated to me by Mr. Repp, one of the proprietors of the sick cattle:

On August 1, 1888, the firm of Reck & Repp, of Union Bridge, Md., shipped from Waynesborough Junction, Augusta County, Va., a car-load of cattle. On August 10 they shipped another from the same place. These were taken directly to Union Bridge and distributed.

The first car-load consisted of 21 head; 7 head of these were driven to the Repp farm and 14 distributed in various quarters. The second car-load contained 13 head; of these 2 cows were sold and 11 were driven to the Repp farm. Within four days 8 head were variously distributed. Of the 10 head taken to the Repp farm 1 was sold to Mr. Lee Stoner, of Union Bridge, after a period of three weeks; another was sold about the same date to Mr. Repp's nephew: 1 was killed on the third day; 2 were killed after two weeks; 3 died on the home place; 1, a young bull from the second car-load, was still left September 9. The remaining animal is unaccounted for. Of the first car-load lot, 3 died; of the second, 2.

Besides these introduced cattle 1 native cow belonging to Mr. Peter Perry died. This cow had been pastured on the Repp farm; she was removed from it for a day or two in the week preceding her death, but was returned. She died on the 5th of September.

None of these animals were ill longer than two or three days preceding their death. Their symptoms described were thirst, cold horns, constipation. In one the bowels were loose; nearly all manifested pain. Some pressed the head against some object; some had paroxysms and groaned for two hours before death; others had their necks extended rigidly to the left. In these the muscles relaxed about two hours before death. The urine was like strong coffee. The natives may have had bloody urine.

The only animal that remained long on the Repp farm and is still alive is the young bull, which was seen to have been around each cow that died. These cattle, however, came from a county north of the permanently infected region in Virginia, and the young bull was said to have been raised there. No cattle that were delivered to other farms died, and in but one instance did I hear any report of illness.

These two car-loads were brought together on the 1st and 10th of August. If the disease was a communicable disease and originated from some of the members of either herd, then it must have originated no earlier than the 1st for one car-load and the 10th for the other. As the cattle died about the same date it would be fair to assume that, were the disease a communicable one, the date of infection would be no earlier than the date of arrival of the second car-load, about the 10th of August.

The difference in time between August 10th and the dates on which the cattle were taken ill is fourteen, fifteen or sixteen, sixteen, seventeen, eighteen, and twenty-four days. These dates would be the period of incubation of the disease. The period of illness was about two days.

From the history of the above outbreak, the clinical symptoms, the period of time before the illness and the length of illness, I am

of the opinion that it was due to the Southern cattle fever, the germs of which were taken into the animals on the Repp farm, and distributed there by either cattle of that lot or some lot previously pastured there.

Since closing the above report I have received information which throws suspicion upon the Norris pasture as the place where most of the cattle were infected. Mr. George D. Norris, writing from Unionville under date of October 18, 1888, says:

I lost 6 animals in all—4 cows, a bull, and a heifer. All died with the same disease except the heifer. She did not open like the others. Her bladder and gall-bladder were different. * * * There have not been any cattle on the meadow since. Horses and sheep have been pasturing there. We hope that it has all passed away. * * * Cattle that were pastured next to my meadow did not catch the disease. I believe, and so do others, *that it was from the other bunch of cattle and not from the bunch that died that my cattle caught the disease*, and if I had not run my cattle on the meadow I do not believe that I would have lost any.

Again, on March 28, the same gentleman wrote:

Both the cow and steer that William Baker lost were pastured on my meadow. Mr. Etzlor is the only man that lost a cow (native) who bought any out of the 72 bunch. The bull was the fifth one to die, and they died one week apart. * * * Mr. Devilbiss, to-day, said that he bought them (the other bunch of cattle) in Baltimore, and they were put in my meadow on June 26. Sixteen head of these were butchered and 10 head were taken back to Baltimore. * * * They were Cherokee cattle, and were full of ticks.

Mr. Repp, of Rech & Repp, of Union Bridge, reported at the time of my visit to that place that he bought 7 or 8 head of cattle of Mr. Darius Devilbiss, of Unionville, in May or June. The latter says that half of these were natives and the other half were Chicago cattle. These were exchanged about June 26. They were pastured on the home farm of Mr. Repp. On referring to a letter of Mr. George D. Norris, recently received, I find that this is probably a portion of a herd that was on his meadow at that time, and by which he thinks his meadows were infected. These were Chicago cattle bought of Charles Ruder, and were a lot of 26 head.

Should it be true that an earlier herd infected the pasture, then the stage of incubation would be shortened for the herd of 72 animals. The various circumstances surrounding the deaths of native cattle would be slightly but not materially altered. There being two chances of infection, an acceptance of either to the exclusion of the other should be considered conservatively, and in accordance with the light which the known facts throw on the case. The history of the herd and diseased natives after the herd reached the Norris farm is very definite.

Respectfully submitted.

COOPER CURTICE, D. V. S.

ANTHRAX AND SOUTHERN FEVER AMONG CALIFORNIA CATTLE.

Hon. NORMAN J. COLMAN,
Commissioner of Agriculture:

SIR: In accordance with instructions by telegraph, dated November 10, 1888, I proceeded to San Diego County, in this State, to investigate the cattle disease there predominating. The result of my investigations I herewith respectfully submit.

On my arrival at San Diego, finding that my written instructions had not yet arrived, I thought it the better plan to inform myself on the following points: (1) The direction in which the said diseases were supposed to exist. (2) The ranches on which said cattle were dying. (3) The health and condition of the cattle in San Diego County and its surroundings. In the course of my inquiries I came in contact with the following-named gentlemen from whom I elicited the appended information. The first gentleman I interviewed was Mr. George Sellwyn, of the firm of Sellwyn & Allison, wholesale butchers. He said:

I have been twenty-three years in this county, and have known of the existence of disease for the past sixteen years. In the neighborhood of San Diego it has been worse during the last three or four years. Some seasons the disease predominates in one locality more than in another. This year (1888) it has manifested itself principally at Warner's ranch, which is owned by ex-Governor Downey, of California.

Mr. Sellwyn also stated that cattle brought from the mountains during the dry season of the year, to San Diego County, or any part of the coast, are, in about fifteen days after arrival, subject to disease. The disease is of frequent occurrence, and the cattle are slaughtered and used for consumption. He describes the symptoms and the *post-mortem* lesions, and they correspond to those of Southern fever and splenic apoplexy.

In the course of conversation I obtained the following information about hogs: A disease among hogs made its appearance about two years ago in the pens around the slaughter-houses. The disease has not been so marked, and the mortality has been less during the last six months. He said that in 1887 the mortality reached the enormous figure of 1,000 head. Some of the hogs had red patches along the abdomen, accompanied with a troublesome cough, and their lungs after death were of a red and black color. He said some of the hogs were coughing, and were recently driven out to the slaughter-house, where I found a majority of them coughing. From the characteristic cough I suspected swine plague, and at my request Mr. Sellwyn slaughtered one, when I found the following *post-mortem* lesions: The inguinal lymphatic glands were highly congested, the spleen was very much enlarged, and the pulp was somewhat disintegrated. The mucous membrane of the small intestines was highly congested, especially that of the ileum, around the ileo-cæcal valve. Some circumscribed red patches could be seen but no ulcers. The mucous membrane of the stomach was highly congested,

especially the pyloric portion. The liver was enlarged and fatty. The kidneys were somewhat fatty, and the pelvis was filled with a yellow serum, the cortical portion of the right kidney being studded with numerous petecchiæ. The right side of the thoracic cavity was full of straw-colored fluid, the right lung being adherent to the walls of the thorax. The surface of the lungs was marked with numerous red and black patches of consolidation, which extended beyond the surface of the lung, and almost corresponded to the size of a *lobulus*. There was more or less broncho-pneumonia throughout both lungs. In some parts it had undergone a caseous degeneration, in others it was somewhat gelatinous. The bronchial lymphatic glands were also enlarged. From the above lesions, which I found exactly corresponding to swine plague in the East, I consider the animals were affected with that disease, and recommended Mr. Sellwyn to destroy them all and burn the pens. I forwarded culture tubes which I inoculated from the spleen and lung of the subject, as well as portions of the spleen and lung, in alcohol.

Mr. Sellwyn further remarked that big-jaw, or actinomycosis, was occasionally seen in this country. Black leg or symptomatic anthrax was very prevalent a few years ago, but of late years has been on the decline. Scab in sheep is, however, very prevalent.

The next gentleman I interviewed was Mr. Hardy, wholesale butcher of San Diego. He informed me that he shipped cattle in April and May, 1888, to San Diego, and pastured them in the El Cajon Valley. They appeared healthy until the month of August, 1888, when about 2 per cent. died. He stated that Mr. Shutton's cattle, also in the El Cajon, began to die, when he sold the remainder to him (Mr. Hardy), who found on slaughtering them that 2 were diseased, the spleens being three times their natural size, and on section of a dark black color. The livers were spotted and covered with yellow streaks, like straws laid across. The kidneys were also diseased. The flesh when dressed was of a light yellowish-red color. Mr. Hardy further stated that 50 per cent. of the cattle within from 10 to 30 miles from the coast in San Diego County take this sickness, and about 20 per cent. of the sick animals die, and it appears to be worse between the 1st of July and the 1st of December.

Concerning hog diseases Mr. Hardy said that he lost between 500 and 600 head of hogs eighteen months ago, which he valued at \$2,500, from what he called hog cholera.

The next gentleman was a Mr. Cassidy, who stated that during the preceding ten years the average mortality among hogs was about 20 per cent., the money value of which was about \$1,000 a year. He also informed me that one year his cattle died, but those of his neighbors did not, although they were only separated by a wire fence, and that next year his neighbors' died and his did not. He had observed that cattle brought from the north to this county do not thrive, but that yearlings and calves thrived and did well; also that mountain cattle brought to the coast die, but that coast cattle taken to the mountains did well.

The next gentleman was Thomas Alvarado, of Rancho Monserrate. He first noticed disease on his ranch about ten years ago, and it was in his opinion brought in by cattle from Lower California and Mexico. Last year he lost about 60 head, and his neighbor, H. H. Gunn, lost over 100 head. The cause was, in his opinion, Southern fever. He first noticed this disease in the county about eighteen years ago, directly after Judge Weatherby brought in 200 cows from Arizona.

His brother, D. Alvarado, of Cuero, lost over 60 head last year, and considered his losses due to Southern fever.

I now left for Warner's ranch, and on my way I passed through the El Cajon Valley, and was informed there was at present no sickness or deaths among the cattle, nor could I discover signs of any. On passing the Santa Marie ranch I was informed that they had lost 10 or 12 head, but attributed the loss to black leg. I interviewed a Mr. Johnson, who lives 7 miles above this ranch, and he informed me that in 1883 he lost 20 head of cattle out of a total of 60 head, and attributed his loss to Southern fever.

In the evening I arrived at Ballena, and next morning drove to the Warner ranch, where I found that the manager, Mr. Linton, was not at home, having gone to Julian, intending to continue his journey to San Diego. I had a conversation with one of his men, who informed me that they had lost over 100 head of cattle, that they ceased dying a few days before my arrival, and a short time after the first frost, and I therefore could not make an autopsy. I decided to go on to Julian and personally interview Mr. Linton. This gentleman confirmed the statements made by the man I had seen in the morning. He also added that he purchased and brought some cattle from the San Felipe ranch, which adjoins the Warner ranch. A little later ex-Governor Downey, owner of the ranch, bought 400 Chihuahua steers, shipped from Mexico to Colton by a man called Strausenbach, that said cattle were delivered by Strausenbach on the Warner ranch, and a short time after their arrival the natives began to die. Mr. Linton ascribed the cause of these deaths to the arrival of the San Felipe cattle. I found, however, that the other half of the San Felipe cattle, purchased by Joseph Marks, merchant at Julian, and removed by him to San Bernardino, remained perfectly healthy and as yet have caused no disease among the other cattle at that point. On the contrary, some of the San Felipe cattle on the Warner ranch died soon after the advent of the 400 steers from Chihuahua, of which none died. Mr. Linton described the symptoms of the disease in the following manner: They hung their heads, had a staring coat, and eyes somewhat sunken and staring, and voided in most cases bloody urine. The fattest and best were first to die; others lingered for days and some eventually recovered. On opening some of the dead cattle, he found the spleens enormously enlarged, the liver of a red-brick color, and the gall-bladder full of dark-green bile. There was absence of any dark stain to the flesh, which was, if anything, brighter than usual. The Indians and half-breeds devoured the flesh of most of those that died without as yet having experienced any bad effects, which could scarcely have been possible had it been anthrax. Mr. Linton owned to having lost 100 head, but I am inclined to think that he underestimated his loss, as his nephew informed Mr. Bishop, his neighbor, and one of his men, who informed me, that they had sold 150 hides, and that others were missing which they did not find, placing the loss, in his opinion, between 180 and 190 head.

From Julian I went to Governor Waterman's ranch, at Cuyamaca, and on arrival was informed that a valuable Hereford bull had died that morning after a short illness, and had been buried but a few hours. I had it disinterred and made an autopsy, with the following results: Spleen enormously enlarged, being three times its natural size; capsule hypertrophied, and covered with white spots. On section, the splenic pulp was disintegrated but still held its consistency,

unless pressure was used, then it oozed out. The liver was considerably enlarged and of a brick-red color, its surface being covered with yellow streaks. The gall-bladder was enormously distended and full of dark-green, inspissated gall. The kidneys were somewhat fatty, with more or less parenchymatous degeneration, and in the pelvis a yellow, viscid fluid was present, somewhat adherent to the mucosa. The mucous membrane of the bladder I did not see, as it was too much covered up, but the lungs were somewhat congested. The flesh was of a bright yellowish red, and the blood was of a bright color, and coagulable. Coverglass specimens from the spleen and liver stained with methyl-violet blue and with Johnis-fuchsin, revealed nothing, and I gave as my diagnosis Southern fever.

At this ranch I interviewed the foreman, Mr. B. W. Carey, who said:

We have lost in all 21 head. We shipped cattle from the Penasquitos ranch on the coast to San Bernardino by car, in April, 1888. These cattle remained there three months. In July, 1888, we re-shipped them with others back to the Penasquitos ranch, and in about two weeks after their arrival two deaths occurred, and we started the cattle next day for the Cuyamaca ranch, driving them by way of Poway and El Cajon, and on arrival at Cuyamaca 3 died the same night. We then had no death for a few days, when 2 more died. They all exhibited the same symptoms. Mr. Shutton's cattle commenced to die after Governor Waterman's passed through. Mr. Shutton then shipped the remainder to San Diego and they were slaughtered.

I must here refer you back to my interview with Mr. Hardy, at San Diego. Mr. Hardy shipped cattle to El Cajon in April and May, 1888, and they began to die in August, 1888. Governor Waterman's cattle having gone through at the end of July or beginning of August, on their way to Cuyamaca, it would appear that the governor's cattle may have infected both these herds, as the two cattle which Mr. Hardy slaughtered at San Diego, and which he believed to be affected with Southern fever, were taken from the remainder of Mr. Shutton's herd, which Mr. Hardy purchased from Mr. Shutton. In connection with Governor Waterman's cattle I must state that yearly deaths take place at the Penasquitos ranch. It is, however, a curious fact that none of the cattle shipped to San Bernardino from Penasquitos died, but that the deaths took place two weeks after their return with other cattle to Penasquitos, which the governor's son informed me came from their San Bernardino dairy. It is a well-known fact that deaths have occurred close to Colton (which is 2 miles from San Bernardino), from Southern fever, and it may be that Governor Waterman's cattle crossed a trail and became infected, or became infected from the cars on their return to Penasquitos, but these being native cattle could not infect Hardy's and Shutton's herds unless some Southern cattle were mixed in the herd. It is also a fact that the bull that died at Cuyamaca ranch was raised on that ranch, and that there were no deaths there until the arrival of the herd from Penasquitos. I am informed that the original stock of those two ranches was brought in by Colonel Taylor from Springer, N. Mex., Iowa, and Kansas.

I also examined the remainder of the herd at Cuyamaca, and they appeared healthy, with the exception of one Hereford cow. It was very much emaciated, and I informed Mr. Waterman, after examination, that in my opinion it was a case of tuberculosis, and advised him to destroy her, which he did, and the *post-mortem* confirmed the diagnosis.

I left Cuyamaca to trace up the infection on Warner's ranch, and on my way passed through the San Felipe ranch, which adjoins Warner's, and I found they had lost 3 head, and attributed their loss to black leg. During one year, they informed me, they had lost a considerable number with black leg, in fact it was of annual occurrence. I now crossed the Warner ranch for the second time. I passed through the center of the Chihuahua steers, all of which, as well as the natives, seemed in splendid condition, no deaths having occurred since my first visit. In following the trail of those cattle the first place I reached was Oak Grove, owned by Mr. Studsbaker, who informed me that the Warner steers passed through his place and up to the present no deaths have occurred, but that 1 of his cows was sick and passing bloody urine. He said, also, that one of the Warner steers had mixed with the herd. From here I proceeded to Temecula, and found that a great number of cattle had died around this place. Here I interviewed the following-named gentlemen:

Mr. E. J. Talan stated that he had lost 1 heifer three weeks after the Warner ranch cattle passed, and that two years ago he lost 13 head on the same trail. Mr. Nickels, I was informed, lost 10 or 12, and Mr. Philip Cases lost 5 head. I went to Mr. Hutchinson's dairy farm, and he informed me that he had lost about 20 head of dairy cows, and that most of his herd had been sick. He opened some of those that died and found the gall-bladders enormously distended and full of dark-green inspissated gall, and the spleen enormously enlarged. All those he opened presented similar appearances. The first animal that died was his best and fattest cow, which occurred, as near as he could remember, in the middle of July. Previous to that some long-horned steers were seen on the adjoining hills, and two of them came down and mixed with his herd, and were with them for several days. Mr. Linton, manager of the Warner ranch, informed Mr. Hutchinson that those Chihuahua steers were scattered from Colton to his ranch, some 30 or 40 being missing.

Mr. Gibson, at Niger Cañon, 5 miles above Temecula, lost 10 head, some of those roving steers also having appeared around his place. Mr. Brady, 3 miles from Temecula, lost 15 head, and he also said that the Warner steers came through in August, and that his cattle began to die before they came through, and a Mr. Hutchinson informed me that long-horned steers were seen on the hills around Temecula as early as the 6th of July. They could not have been stragglers from those that went through in August.

Having gained all the information I could at Temecula, and the evidence being somewhat conflicting, I now proceeded to the Santa Margarita ranch, leaving the Warner trail, as I was informed other trails came through Temecula, some of the cattle going to Santa Margarita, and others to the coast ranches around San Juan de Capistrano and Santa Ana. Mr. O'Neil, of the Santa Margarita ranch, informed me that when the Chihuahua steers, sold to Governor Downey, were pastured on the Castile ranch, 15 miles from Colton, he went to see them, but declined to purchase.

On the 12th day of July, 1888, I delivered cattle to Hardy, of San Diego, and he informed me that he had seen long-horned stragglers at Temecula.

This seems to coincide with the date of the death of Mr. Hutchinson's cattle. He also said that Colonel Taylor brought cattle from Texas to Cuyamaca and Penasquitos, some of which were of a high grade, and that two years ago they died. The Texans, in his opin-

ion, infected the high grades, which, undoubtedly, were those mentioned by Governor Waterman's foreman as coming from Kansas and Iowa. Mr. O'Neil also informed me that they are constantly killing Texan and New Mexico cattle in San Bernardino City. His own losses had been about 10 to 15 head this fall, which he attributed to cinnabar ore or mercurial poisoning, the mercury having been washed down by the rains into the drinking places, and other deaths he attributed to ticks; but I am not inclined to believe either of those theories, because it is well known if an animal is sick and seeks solitude in the scrub that is the time that the ticks will attack him, and as a cause of death they may assist indirectly, helping to weaken an already emaciated animal. From what I heard from Mr. O'Neil's neighbor, Mr. Foster, I am inclined to think that the poison on his place is Southern fever.

From here I went to San Juan de Capistrano, and interviewed Mr. Marcus Foster. He said that Mr. O'Neil brought cattle on to the Santa Margarita ranch, which adjoins his, and that they broke down the fence and mixed with his, and he lost 100 head. Next year the same thing occurred, and the animals mixed with his as well as others which he brought from Arizona, and he lost from 800 to 1,000 head. This year (1888) he lost about 100 head. He further remarked that all the ranches below had been affected in a similar manner, and as they never had had this disease before it must have been brought in. I made an autopsy on this ranch and found the lesions those of Southern fever.

I now started back on the trail of the Warner steers and went to Colton. I here interviewed Mr. Castile, owner of the Castile ranch, and he informed me that Mr. Strumsbaker brought 400 steers from Chihuahua, unshipped at Colton, and drove them to his ranch 15 miles from Colton, about June 6, 1888, and pastured them there two months. He then sold them to ex-Governor Downey, and his son helped to deliver them on the Warner ranch. He denied losing any on the way. He further said that a year ago, in September, 1887, he lost 56 dairy cows, which he valued at \$3,000, and ascribed the cause to cattle being driven across the ranch. This year he had lost none.

I now proceeded to the Southern Pacific office at Colton, and found the shipments to this point as follows:

(1) From Benson, Ariz., for Mr. Marcus Foster, San Juan de Capistrano, unloaded May 4, 1888.

(2) From Tuscon, Ariz., for Mr. Marcus Foster, San Juan de Capistrano, unloaded April 6, 1888.

(3) On March 13, Strumsbaker shipped in 113 head, which I found were slaughtered at Colton and San Bernardino.

At the Santa Fé office in Colton I found that Strumsbaker shipped 400 head of cattle from Chihuahua, which arrived June 5, where they were unloaded and sent down to the Castile ranch as already stated.

I had the greatest difficulty in getting my questions answered, and in a good many instances, instead of trying to assist, they tried to mislead and perplex me.

Having now obtained all the evidence I could concerning the outbreak of disease in San Diego County, and with due regard to conflicting statements no doubt purposely made in a great many cases, I draw the following conclusions:

That Texan, Arizona and Mexican cattle have been shipped into Colton and from there traveled by the trail going to Warner's ranch

and that going to Capistrano; also by O'Neil's trail from San Geronia to Rancho Santa Margarita, and that the cattle infected these trails and the individual ranches, and by that means caused the death of so many native cattle in San Diego County. The only objection I can see to these conclusions is, can permanent infection exist, as Mr. Mercer was inclined to think during our inspection in the Salina Valley of Monterey County? To prove this would require further and special examination of the various ranches in California at a time when the disease is at its height.

In Los Angeles City, Dr. Whittlesey, V. S., drew my attention to the fact that some cows had died within the city limits from what he supposed was Southern fever. The cows belonged to Mr. W. W. Cate, who said that his cows died from red-water and were treated for the disease by an empiric without any of them recovering. The animals were in the habit of grazing in the river bottoms, along which river bed Scanton Bros., owners of the Orleans market, were in the habit of driving their cattle in order to reach their slaughter-house, 10 miles from the city. In this way Dr. Whittlesey considered that Mr. Cate's cattle were infected.

Leaving Los Angeles I went to Hanford at the request of the State board of health. On arrival I met J. A. Davidson, M. D., who informed me that at the request of the board of supervisors he went out and examined some 316 head of cattle brought from the Salina Valley and pastured on alfalfa. After being there three weeks they commenced to die. He quarantined them. Mr. Motheral informed me that the cattle, in coming to Hanford, passed through Polly Helbrun's ranch, where cattle have been dying in great numbers. The mortality ceased soon after their arrival. Mr. Motheral, who used to farm in Mississippi and Florida, said he had had experience with Southern fever, considered the symptoms and *post-mortem* lesions of these cattle those of Southern fever, and laid particular emphasis on the fact that after the frost came they ceased dying.

Mr. J. E. Tilton, who lives $4\frac{1}{2}$ miles from Hanford, informed me that he had lost 19 head this year, and 16 head last year. He usually carried about 40 head of cattle. This year they began to die about the 1st of September. In August some cattle came in from the Coast Range of mountains. He cut some of the dead cattle open, and found the omasum hard and dry. The spleen was three times its normal size, and was black. Some of the animals before death voided bloody urine. Some died quickly while others lingered for days. The fattest died first. I went to Mr. Sandford's ranch, 4 miles from Hanford, who informed me that he sold his hay to Polly Helbrun & Co., to feed to cattle on his ranch. They brought in about 1,400 head of cattle, and two or three days after arrival they commenced to die. About 450 died on the Polly Helbrun ranch before they left. I made two *post-mortems* here. The first was a cow that got down and was killed the same day I arrived. I found the following lesions: Spleen slightly enlarged, but the pulp was normal. The liver was enlarged and of brick-red color, and the gall-bladder immensely distended and full of dark-green, inspissated bile. The kidneys I found congested. The stomach and intestines were in a normal condition, as were also the heart, great vessels, and the blood. The lungs were both affected with broncho-pneumonia, being variegated, brown and red lobuli alternately. I split open the bronchial tubes, and found them full of the *Strongylus micrurus*, causing parasitic bronchitis. Microscopical examination failed to reveal anything. Numerous other animals

were coughing, so I recommended for each affected animal the following:

Spirits of turpentine, $1\frac{1}{2}$ ounces; linseed oil, 1 pint. Mix and make one drench; give immediately.

I considered this the safest thing to give them, as it would be impossible to give inhalations, and I had no inter-tracheal syringe with me.

The next autopsy was a calf that died two days before I arrived. The weather was cold, and there was not much decomposition. The spleen was enormously enlarged, being at least three times its natural size, and on section was black, but not entirely disintegrated. The liver was enlarged, fatty, and of a brick-red color; the gall-bladder was distended to a great size, and full of gall. I did not examine the other organs, as there was so much *post-mortem* staining. The flesh was, if anything, brighter than normal, with a yellowish-red color. Microscopical examination failed to reveal any germ, except a few putrefactive bacteria, and as the animal had been dead so long I could not give a definite opinion, but considered the lesions almost identical with those of Texas or Southern fever.

It would seem in this case that the infectious principle came from Polly Helbrun's ranch, and that the other deaths reported by Dr. Davidson were due to infection in passing over Polly Helbrun's ranch, or they were infected before leaving the Salina Valley; but the former, in my opinion, is the more likely, as the number of deaths at Polly Helbrun's during the past few months would indicate considerable infection in that locality.

Finding the death rate at a minimum and no other places to visit, I returned to San Francisco.

Very respectfully submitted.

THOS. BOWHILL, M. R. C. V. S.

SAN FRANCISCO, CAL., December 13, 1888.

FURTHER INVESTIGATION BY DR. A. J. CHANDLER.

In February, 1889, Governor Waterman, of California, telegraphed that the disease was still prevalent among cattle in San Diego County, and asked that a competent veterinarian be directed to make a further investigation and give such directions as might prevent its extension, and ultimately result in its suppression. In compliance with this request Dr. A. J. Chandler, veterinary surgeon for the Territory of Arizona, was directed to visit the locality. The results of his investigation will be found embodied in the following report:

Upon receipt of your telegram I at once started for southern California, and while in Los Angeles accidentally learned of the district in San Diego County in which the disease existed, which proved to be on the Los Penasquitos ranch, about 15 miles north of San Diego, 5 miles back from the coast, and leased by Governor Waterman. Upon investigation I found that about 100 head of cattle had been affected with the disease, some 30 of which had died. Among the latter were some very valuable Hereford bulls. A number were on a fair way to recovery, while a few were beyond hope. The disease is undoubtedly Southern fever. I made two *post-mortem* examinations, one upon an animal which had died just before my arrival and the other upon an animal I had slaughtered. In both instances the spleen was enlarged, the liver yellowish brown and increased in weight; the gall-bladders were enormously distended, and filled in one case with yellowish fluid bile and in the other with a dark brown and very thick fluid. The urinary bladders were filled with dark bloody urine. The kidneys were congested and enlarged

and the cortical substance softened; the subcutaneous alveolar tissue and the mucous membranes of a yellowish tinge. The blood fluid was of a bright red color. The symptoms are high temperature, rapid pulse, staggering gait, and in some instances delirium. The following history of the outbreak is thus given:

In April, 1888, 84 head of cattle were driven across country from the Penasquitos ranch to San Bernardino. In July part of the same herd, and cattle from the Dairy ranch at San Bernardino—73 head in all—were driven to the Penasquitos ranch. Two weeks after they reached the ranch they commenced dying. Those coming from the Dairy ranch became affected, while those from the Penasquitos ranch remained healthy. Three died at Penasquitos ranch. The remainder were started to a mountain range—the Cuyamaca; 7 head died on the way, and the remainder within three weeks. Three hundred and five head of cattle were driven from the Cuyamaca range, which has an elevation of between 4,000 and 5,000 feet, starting on the 5th of January, 1889, reaching the Penasquitos ranch on the 8th of that month. The cattle began to die on the 24th, and at the time of my visit to the ranch some 30 had been lost. Running with these cattle were 70 head belonging to Mr. Taylor, and raised on the ranch. Up to this time they had remained perfectly healthy.

From San Diego I went on to Kern County, examined many of the large ranges, and made inquiries of the inhabitants and of the county physician. I saw many herds of cattle, but could not find or hear of any disease among them. During the early part of the fall several hundred head died, and from the description of the disease as given by the cattlemen I think it was anthrax.

DESTRUCTION OF CALIFORNIA CATTLE BY VARIOUS DISEASES.

Hon. NORMAN J. COLMAN,
Commissioner of Agriculture:

SIR: In accordance with your telegraphic order of September 28, 1888, I employed Dr. Thomas Bowhill, M. R. C. V. S., and at once took the field to investigate the causes of the great mortality among the cattle in Monterey County, this State.

Arriving at Cholone, a station on the Southern Pacific Railroad, we visited the herd of E. J. Breen, and found that during the month of September he had lost over 900 out of a band of 1,200 cattle, and nearly 100 others were suffering from the disease. Two cows were killed that were in the last stages of the disease and autopsies made. These are hereto attached and made a part of this report. Texas fever was the trouble.

Proceeding to Coburn's ranch, we found 13 cases of actinomy cosis and some tuberculosis. Two animals were killed, autopsies made, and the results herewith submitted.

At Soledad we examined one cow and pronounced it splenic fever. Around this village nearly all the cattle are infected, and hundreds have died. While we found no anthrax, there is no doubt in my mind but that the disease exists here, and probably more than half of the deaths have occurred from this cause.

Visiting Gonzales, we found the whole region round about rotten with anthrax. One herd of 800 cattle placed in a stubble field July 15 had suffered a loss of 100 head, and the autopsies showed anthrax clearly in the general condition of the organs, and under the microscope the anthrax germ. Autopsies herewith inclosed. Two horses were examined and anthrax found. Autopsies also inclosed. At this place the Spanish residents are in the habit of eating the meat of the dead animals after "jerking" it, and the local physician reports 14 deaths among their children from putrid sore throat, caused, he says, by eating this diseased meat. Quantities of it are being shipped to San Francisco, and this fact I have reported to the board of health there. Proper action will be taken.

Diligent search was made for the history of the causes leading to these outbreaks, but the shortness of the time given for investigation rendered it impossible to gather reliable data. From all the facts attainable, I am of the opinion that there is a considerable area in this State that is permanently infected with the germs of splenic fever. The Salina Valley, where this outbreak occurred, was visited last winter by cold sufficient to freeze the ground to the depth of an inch. Certainly this would kill the fever germs. Many cattle have been brought in this year from the San Joaquin Valley and other parts of the State to feed on the stubble, but none can be found that came from Texas or other southern points east of the Rockies. I am not prepared to say definitely that the Texas fever originated here, but there is much to induce the belief.

Second-hand evidence is in abundance to prove the presence of anthrax in almost the entire portion of the State south of San José. In the fields around Gonzales, and many other sections, the hogs all die from eating the dead cattle, and the horses and sheep take on the contagion. Numerous cases of blood poisoning from contact with dead carcasses have occurred, all being marked with the signs of anthrax.

The mortality among cattle, horses, and sheep has been, and continues to be, very great throughout the southern counties, reaching well up into the thousands. But my limited time prevents an ascertainment of exact figures.

I send you specimens of the work done in the field from which you can verify our work. The situation here is so serious that it seems to me you would be fully justified in detailing some one for a term of months to ascertain *all* the facts in regard to the various diseases among the domestic animals of the State, and if possible to locate the line of Texas-fever infection.

Very respectfully,

A. S. MERCER,

Inspector Bureau of Animal Industry.

SAN FRANCISCO, CAL., October 9, 1888.

AUTOPSIES.

The report of the autopsies made by Dr. Bowhill is as follows:

1. *Autopsy at Breen's ranch.*—A two-year-old heifer was found on hill-side. Took temperature and found it 102½° F. About two minutes afterwards, with a few convulsive movements, she died, but there was absence of any difficult breathing. On cutting through the skin to remove the fore limb prior to laying open the left side, the first thing that drew our attention was the escape of a bright, brick-red colored blood, which was very thin in consistency, and seemed to coagulate more rapidly than normal blood. The flesh was of a bright red color, and the fat between the muscles, as well as that of the areola tissue, was of a deep brownish-yellow color. On cutting along the linea alba and removing the whole of the left flank as well as the ribs, and exposing the thoracic and abdominal cavities, the first thing that drew our attention was the enormous size of the spleen, 19½ inches long and 16 inches in circumference. It was of a dark purple color; the capsule was not studded with any petecchiae, but on section it was found that the splenic pulp consisted of a disintegrated mass and had lost all its consistency, but you could carry it and it would remain intact, except when the capsule was cut. The contents would not, when held by one extremity, fall down to the other like an hour-glass as I have found to be the case in anthrax splenic apoplexy. Coverglass specimens of this organ do not reveal the presence of any bacilli. I next removed the stomach. It was normal as were its attachments, and also the omentum inguinal, excepting its yellow color. On cutting into the rumen we found it healthy and full of food. The reticulum was in a like condition. The omasum was very hard and impacted, much more than is the case in a healthy animal. The abomasum was almost entirely empty, and its mucous membrane, especially the pyloric portion, highly congested and covered with ecchymosed patches. The small intestines were healthy excepting the mucous membrane, which was strewn with bile. A like condition applied to the large intestines. The liver was enormously enlarged and of a light, brick-red color, inclining to a dark yellow, almost resembling powdered cinnamon. When cut into it was fatty, and light red blood escaped, as well as an excess of bile. The gall-bladder was distended and thickened in its walls; it was full of dark yellow gall and slightly inspissated. The liver substance was also traversed with yellow streaks, due to the engorgement of the bile duct. The kidneys were somewhat enlarged, and on section the cortex was softer than natural, and numerous petecchiae could be seen throughout its substance. The medullary portion seemed to have undergone parenchymatous degeneration. There was no pus in the pelvis, but the fat was soft and of the same peculiar yellow color above mentioned.

The bladder was distended with bloody urine, and its mucous membrane somewhat congested. On removing the diaphragm I cut the post vena cava and thin red blood escaped, which formed a clot resembling red-currant jelly, and was so tenacious that you could take it up and let it fall and it would still retain its consistency. In handling it would leave no stain on your hands. The lungs were in some parts slightly emphysematous, and several portions were affected with hypostatic pneumonia. The pleura costalis was slightly congested, the heart was of an enormous size, and the pericardium covered with petechiæ, and on section it was normal. The fat around the heart was of the same yellow color.

2. *Autopsy at Breen's ranch.*—A four-year-old cow, temperature 104½° F., was blowing heavily and frothing at the nostrils and mouth. She was unable to rise, and being in the agony of death was destroyed by severing the spinal cord. The same appearances were present as in autopsy No. 1, except the spleen was much larger, being 24 inches long and 16 inches in circumference, and the four compartments of the stomach were healthy, especially the third and fourth, which were full of food. The kidneys were healthy and the urine was not bloody, but of a natural color. The liver was greatly enlarged, and the gall-bladder as well, which, on section, was full of dark-green, thick, inspissated gall. The lungs were slightly emphysematous, and the bronchial tubes full of frothy mucus. The heart was healthy externally, but the endocardium was studded with straw-colored excrescences. The blood in this case was even more coagulable than in No. 1. The coverglass specimens of the spleen of these two animals failed to show, when examined microscopically under ½ Cronech lens and stained with an alcoholic solution of methyl blue and methyl violet, any signs of the *Bacillus anthracis*, a result I fully expected as soon as I opened the first animal and saw the condition of the blood. One would judge from the *post-mortem* appearances that the above-mentioned animal died from the effects of splenic or Texas fever, but as the history of the outbreak has not yet been thoroughly investigated, and as further autopsies are to be made, it would be premature to offer a final opinion.

3. *Autopsy at Soledad.*—Three-year-old steer, the property of Mr. Victor. This steer was well in the morning according to the cowboy, but was dead in the evening. It was opened the following morning. Found *post-mortem* lesions similar to those at the Breen ranch. The blood was of a bright red color and very coagulable. The spleen was of an enormous size, about 26 inches long and very much disintegrated. The liver was also greatly enlarged, and the color was the same as found in Breen's cattle. The kidneys were somewhat congested, but as the animal was dead so long this might have been due to *post-mortem* staining. The lungs were emphysematous, accompanied with hypostatic pneumonia. The intestines were normal. In this case the omasum was not impacted, but the abomasum had its mucous membrane congested. The bladder was full of bloody urine. Coverglass specimens from the spleen stained as before did not reveal the *Bacillus anthracis*, but numerous *Bacterium termo*. Considering these three autopsies, made on the most recently diseased animals in the course of investigation, as well as the history acquired at Soledad, I have no hesitation in pronouncing the disease as splenic or Texas fever.

4. *Autopsy at Coburn's ranch.*—The first animal was a two-year-old steer suffering from osteosarcoma, big-jaw, or actinomycosis. The part affected was the right ramus of the lower jaw. It was distended to a great extent, and the mouth was twisted to one side. The animal was killed by permission of the owner, and an examination made resulted as follows:

Right ramus of lower jaw, weighing 10 pounds, was found honey-combed, and the openings full of detritus and pus of a thick ropy consistency, somewhat caseous. The teeth were loose in the jaw, and the posterior molars fell out. I next examined the lungs, and in the right, which was slightly hepatized, I found two small miliary tubercles, evidently due to the actinomycosis fungus, as coverglass specimens of the caseous matter from the jaw, when stained with alum-carmin, revealed the presence of those fungi in great numbers. All the other organs were in an apparently healthy condition, except the mucous membrane of the abomasum, which was highly congested, indicative of gastritis. Thirteen animals on this place were affected in a like manner.

5. *Autopsy at Coburn's ranch.*—A long yearling heifer was driven in, blowing considerably and with a peculiar cough. Caught her with a rope, and took temperature, finding it to be 104° F. Percussion of the chest revealed the following: Patches of consolidation studded here and there over the surface of the lung, and both lungs affected, the right being the worse. Diagnosed as tuberculosis, due to either the *Bacillus tuberculosis* or the actinomycosis fungus. I advised the owner to destroy the animal, which he did. On opening the thoracic cavity the following condition of the lungs was found: Pleuro-pulmonaria of right lung adherent in four places to the pleura costalis of same side. This was more or less broncho-pneumo-

nia, with large patches of consolidation throughout both lungs, and studded with masses of tubercles. The other organs of the animal were healthy.

6. *Autopsy at Gonzales.*—In pasture of Lux & Miller, about 1 mile from town, a fine cow died in the night. The day before it was well and showed no signs of disease. It was opened next morning at 8 o'clock, and on section I was struck with the dark color of the blood, which was black and tarry, and did not coagulate. I noticed that the mucous membrane of the eyes and mouth had a deep blue or purple color, and that those of the rectum and vagina were considerably everted and studded with ecchymosed patches and with slight hemorrhages from both openings. The spleen in this instance was also different from the others. On cutting the capsule the pulp was found to be more disintegrated and seemed to flow out of its own accord, and it was so rotten that a specimen could not be transferred into alcohol. The liver was enlarged, and on section there was an escape of black blood. It had an appearance of being boiled. The streaky appearance was of a bright yellow nature; enlarged gall-bladder and bile-ducts, as seen in Texas fever, were not present. The rumen was full of food, and the mucous membrane peeled off on pressure. The reticulum had its mucous membrane in similar condition to the rumen. The contents of the omasum hard, and mucous membrane congested, and part peeled off. The obomasum contained a small quantity of food; mucous membrane very highly congested and entirely abraded in some parts. Intestines highly congested throughout, and covered with ecchymosed patches; the mesentery and peritoneum covered with ecchymosed spots, and the large veins elevated and full of dark tarry blood. Kidneys very highly congested and friable, and the cortical portion studded with petecchiæ; bladder full of sanguineous urine, and mucous membrane congested. Lungs studded with numerous ecchymosed patches, especially on the pleura, and more or less emphysematous. Heart enlarged and serum between its layers, and covered with petecchiæ. The endocardium was studded with ecchymosed spots which could not be removed by washing.

On microscopical examination coverglass specimens of blood from the spleen, stained with methyl violet, revealed the *Bacillus anthracis* in enormous quantities. Taking the *post-mortem* lesions and microscopical examination into consideration, I came to no other conclusion than that this was a case of splenic apoplexy.

7. *Autopsy at Gonzales.*—A three-year-old mare died in the morning and the autopsy was performed towards evening. Examination revealed the blood dark and tarry but somewhat coagulable. The stomach was very much congested, especially the pyloric portion. The small intestines were in a great state of congestion, as were also the peritoneum and mesenteries, and very easily torn, in fact almost rotten. The large intestines were in a similar condition, and the abdominal cavity throughout was so much congested that it resembled turkey red, showing excessive peritonitis with an excessive amount of a bloody serous exudate. The intestines were agglutinated with a brown-colored serous exudate. The mucous membrane of the alimentary canal was highly congested, and one part of the small intestine was constricted and of a yellow gelatinous appearance, while in one place the wall of the gut was nearly 2 inches thick, being infiltrated between the mucous membrane and external peritoneal coat with brown yellow jelly-like mass, the muscular coat being almost entirely obliterated. The spleen was enlarged and the parenchyma of a dark color, but not disintegrated. The liver was fatty, and on section dark-colored blood oozed out. The kidneys were congested, and the bladder was full of bloody urine. The mucous membrane of the rectum and vagina was everted and covered with ecchymosed patches. The heart was healthy externally, but the endocardium was covered with petecchiæ. The lungs were healthy, and the pleura presented ecchymosed patches.

8. *Autopsy at Gonzales.*—The subject of this autopsy was a five-year-old gelding which died the previous night. On opening, appearances were present similar to autopsy No. 7, but this time the constriction was in the large intestine instead of the small, and the infiltration between the coats of the bowels more abundant than in No. 7. The spleen was larger, blacker, and more disintegrated.

Coverglass specimens from the blood of the spleen of Nos. 7 and 8, stained with methyl violet, showed the presence of a few rods and numerous spores. This, with the fact that the animals were only sick a few hours (No. 8 being in seemingly good health and kicking up his heels early in the afternoon of the day of his death, and No. 7 was brought in from pasture early in the morning affected with shivers and a staggering gait and coldness all over the body, and died in great agony), together with the symptoms of the disease and the *post-mortem* lesions found, leave no doubt in my mind that the cause of death was of an anthracoid nature, although only a few rods were demonstrated microscopically.

Respectfully submitted.

THOS. BOWHILL, M. E. C. V. S.

SAN FRANCISCO, October 10, 1888.

SIMULIUM, OR BUFFALO GNATS.

Hon. NORMAN J. COLMAN,

Commissioner of Agriculture:

SIR: I herewith transmit the results of my observations upon the species of *Simulium*, infesting the country adjacent to the Mississippi River, from Missouri southward to the Gulf of Mexico. These insects are generally known under the common appellation of Buffalo gnats, Bull gnats, and Turkey gnats, and while, so far as known the bites of only the first result fatally to horses, mules, and cattle, the others combine with them in the destruction of sheep, swine, and other small animals.

The habits of all of the species of *Simulium*, herein considered, are, so far as known, very similar, and as the species are not generally distinguishable to the ordinary planter, I have thought best to refer to all of them under the general term, Buffalo gnats, although, technically speaking, this term applies to only *S. pecuarum*, Riley. Other species consist of *S. meridianole*, Riley, and two or three varieties yet to be described.

Respectfully submitted.

F. M. WEBSTER.

LAFAYETTE, IND., October 25, 1887.

BUFFALO GNATS.

Habitat.—All species of *Simulium*, infesting the country visited by me, breed in running water, and hence inhabit only the swiftest portion of small or medium-sized streams flowing through alluvial regions. Streams flowing through hilly country do not appear to be congenial to their nature, although the current may be much more swift and broken into shoals and ripples. Sluggish-flowing portions of streams, lakes, lagoons, and swamps are not known to produce these gnats, nor are they supposed to infest the waters of the Mississippi River itself.

The principal breeding grounds of Buffalo gnats, in the Mississippi Valley, are situated between New Madrid, Mo., and the mouth of the Red River in Louisiana. In the latter State they are mostly confined to the region between the Washita and Mississippi, exclusive of either of these streams. In Arkansas they seem to be confined chiefly to the St. Francis, its tributaries, and to those streams whose sources are between the Mississippi and Bayou Bartholomew. The Yazoo country, in Mississippi, suffers severely during some years, but I found no evidence which would warrant that locality being at present included in the chief habitat of these gnats; and the fatality caused is nearly if not wholly due to the immense bands of these insects which are blown by the winds across the river from Louisiana and Arkansas. This is especially true of northern Mississippi and west Tennessee, and really restricts the habitat of the pest to the country along the west side of the "Father of Waters," and limited from north to south as previously stated. That an insect,

whose life during its adolescent stages is so thoroughly dependent upon the current of a stream, should select as its home those streams whose sluggish movement is only broken at intervals by shoals or jams of logs and other vegetation, is rather surprising, until we find that the food supply of the larvæ is nearly, and perhaps exclusively, confined to alluvial streams. Although these larvæ are strictly aquatic, they can only make their way with difficulty in the water in search of food, and must remain, to an extent, stationary, and secure only so much sustenance as the current brings within their reach.

ADULT GNATS.

These make their appearance annually, in greater or less numbers throughout their breeding grounds, from about the 20th of February until the 10th of May, the season of greatest abundance, in extremely favorable years, being from March 20 to May 1. Often, however, this period of extreme abundance is reduced to a week or ten days, but on the other hand, a very few will probably be found as late as August 1, as I observed full-grown larvæ and pupæ only a few days prior to that date.

The adults which make their appearance first are much larger than those coming later, and it is the former to which the greater portion of the destruction of stock is due. This is the *Simulium pecuarum*, which Dr. Riley has described and figured (Report of the Commissioner of Agriculture, for 1886, p. 512, Plate VIII, Figs. 1, 2, 3), and is the true Buffalo gnat. These are soon joined by several other forms, which may or may not prove to be distinct species. The Turkey gnat, *S. meridianole*, Riley (*loc. cit.*, p. 513, Plate VIII, Fig. 4), and another undescribed form will, however, probably prove to be valid species.

These adults emerge from the pupæ beneath the surface of the stream, and the number which will develop in a very limited area is simply astonishing. As soon as they leave the water they betake themselves to the bushes and other vegetation about and overhanging the stream, and remain there until nightfall, when they move off or are driven away by the winds, and appear suddenly and without warning in localities far distant from their breeding places. So immense are their numbers that for weeks the vegetation in the vicinity of these breeding places will be black with them each evening, and these numbers are replaced again, day after day, until one will almost wonder that the stream could have held them all. This nomadic habit, however, only appears in the females, and males are found away from the locality where they originate only in isolated cases, the mouth parts of this sex being so constituted as to effectually prevent the sucking of blood, thereby rendering them harmless on that score. The blood-sucking gnats, then, are all females, and in the case of the larger and most venomous, these females seem to be sterile, or, at least, there is no indication that they ever deposit eggs. Egg-laying females of *S. pecuarum*, and also of at least one other species, have been observed, and one of them was observed ovipositing in great numbers.

PLACE AND METHOD OF OVIPOSITION.

In all cases where female *Simulium* were observed in the act of ovipositing, they selected some locality where the current was not

only very swift, but impeded by trees, brush, stumps, or cane. If the water was seething and foaming, in its onward course, among these obstructions, so much the more attractive it seemed to prove as a place of deposit. By swinging a dugout, myself therein, into the midst of these boiling rapids, and holding it there, I was able to watch the female gnats in their work of oviposition.

The eggs are placed just above the water's edge, upon almost anything situated in the midst of the current, vertical objects seemingly preferred, but, nevertheless, many eggs were placed on the sides of my dugout. Very few eggs are deposited during the forenoon, and as they are dropped about without any system in the arrangement, adhering to the object upon which they are placed, if the flood be falling, there will appear for each day a ring or band of eggs, and these bands, at a distance of a few yards away, have the appearance of rings of scum which has collected and dried. So far as observed, eggs hatch within a few hours, and the young larvæ at once make their way into the stream. Eggs have, however, been kept several days, and yet hatched at once on being placed in water.

THE LARVÆ.

On first emerging from the eggs these are very minute, and it would seem that to trust their tiny bodies to the mercy of a strong current would be to commit suicide, particularly as full-grown larvæ can not swim about freely, as most other aquatic larvæ do. Yet the little things are not easily killed, and seem to be as able to withstand the rough usage of their watery home as when much more fully matured. So far as known the only means of locomotion which these larvæ possess is by crawling about on submerged objects with a slow gait, and letting themselves out from such objects by the aid of a tiny, thread-like spider-web, which they attach at one end and dangle in the midst of the foaming current at the other, sometimes as many as half a dozen on a single thread.

The food of these larvæ probably consists almost exclusively of minute animals, which infest the waters of these inland streams in vast numbers, and this is doubtless one reason why these larvæ congregate only in places where the current is swift, as a fresh supply of food is thereby being continually brought within their reach. One thing is certain, the larvæ, if confined in still water, perish in a few hours. This, however, might be in part due to a lack of oxygen in still water.

The larvæ of most of these *Simulium* live in the streams nearly an entire year before changing to pupæ. There is no indication of more than one brood of adults each year, unless those found in August should prove to belong to a species differing in this respect from all other known southern forms or species.

THE PUPÆ.

In spring, on becoming full grown, the larvæ spin a tough brown cocoon, with the upper end open (see Report of the Commissioner of Agriculture, 1886, Plate VII, Entomologist's Report), within which they transform to pupæ, and thence, in about ten days, to adult gnats.

Unlike similar insects whose habitat is much farther north, the larvæ do not seek secluded places, out of the swift current, wherein

to pass the pupal stage, but transform where they happen to be at the time of reaching maturity, viz., in the swift current. While I have observed the adult gnat emerge from the cocoon, after the latter had been several hours before left above water by the receding stream, and a large number emerged in a cigar box in transit between Louisiana and Washington, D. C., I have never been able to secure adults from pupæ placed in jars of water, though kept in cool places, and do not think they will live any length of time, even in this advanced stage of development, in still or stagnant water. That larvæ may, during high water, be carried out of some streams into others where none had previously existed, and these larvæ pupate and develop to adults, there is no question. Even ravines ordinarily dry in spring are thus transformed into extensive breeding places, as is proven by the great quantities of empty cocoons found there after the water subsides. In no case, however, has this proven true where water simply backed into such ravines, afterwards becoming stationary, moving out again by the way it came, and not producing a running stream.

MODE OF ATTACK.

Although flourishing in a subtropical country, apparently thoroughly adapted to their environment, these insects seem better calculated by nature for a much cooler climate. Instead of reveling in the heat and sunshine of midsummer they shun winter and summer alike and appear in greatest numbers only during that portion of the year when the temperature is the most moderate.

In strict accordance with this characteristic adults are particularly active during cool days and the cooler portions of warm days. As I have stated, the adults are loth to forsake the vicinity of the cool stream from which they emerge until night, which in the South is invariably cool. Hence they are much more active and malignant during cloudy days, late evening, and early morning.

So also does the aquatic habit of the adolescent stages seem to influence the adults. They are always more numerous about shaded lakes or ponds and in the woods, even low, damp, though not wet ravines having considerable attraction for them. Often teams, when at work in the fields, are attacked by gnats in overwhelming numbers on approaching such places, while other localities are comparatively exempt. I have, myself, when riding about on horseback, been suddenly beset by them in such myriads that it seemed as though they would kill my horse beneath me before I could reach a place of safety. During seasons of great abundance, however, they do not confine themselves to such favored localities, but seem to be everywhere present and in about equal numbers.

It is in times of great abundance that vast hordes of these insects are carried about by the winds, and appear suddenly in localities where they were not previously known. At such times cattle will be grazing quietly in the fields, and teams at work without the least indication of attack. But a gale of wind springs up, and in half an hour everything is changed, and a motley collection of cattle, horses, sheep, mules, and drivers come tearing in from the fields, each trying to outstrip the others, all being goaded on by myriads of their tormentors. Stock, and sometimes human beings, are killed in this way before they can reach a place of safety.

The gnats are extremely active, but so quiet in their movements that they attract little attention. They fly low, seldom more than a

few feet above the ground, and with a quick, darting movement catch the end of a hair of their victim, and in an instant have followed it to the skin, and are at their bloody work. They seem to be ravenous in proportion to their numbers, and while the tenderer portions of animals, such as the nose, flanks, and anal and genital regions are the most subject to attack, when they are excessively numerous they do not stand upon the order of attack, or lose any time in making selections, but catch hold anywhere, and in an indescribably short space of time it is difficult to discern whether an animal is black or white, so quickly do they cover the entire body. On reaching the skin they at once insert the stout beak, and do not withdraw it, unless driven to, until filled with blood, when they drop to the ground; the puncture being marked by a large drop of blood, which oozes out of the wound and stands up on the surface of the skin. So far as known, these gnats become gorged with blood but once. I have never been able to make a full-fed individual live more than twenty-four hours, a fact, however, in which there is little satisfaction, as their numbers are incalculable.

That the genital organs, in mules at least, are very susceptible to the bites of gnats, is made apparent by the fact that the fatality is much greater among males than females.

ANIMALS ATTACKED.

Of wild animals the deer is probably the greatest sufferer from attacks by gnats, and in the gnat-infested regions these animals have been well-nigh exterminated by them. So tortured do these poor brutes become that they will seek refuge in the "smokes" made to protect stock, and have even been known to venture into country blacksmith shops to escape their tormentors.

Of domestic animals the mule is, for several reasons, the greatest sufferer, although there is no animal, down to the cat, which is not subject to attack by these pests, and the same principle will apply to fowls.

The greater fatality among mules is owing to their being chiefly in use as work animals, and hence are more exposed to attack. They are at the mercy of careless and ignorant attendants, who do not use proper precaution in their management, nor obey instructions in regard to the use of repellants furnished them. Then, a mule in harness has little means of self-protection except in running away. We are content to accept the horse very much as nature furnishes him to us, but we can never consider a mule as finished until his tail is shorn, and in this case the use of this appendage is denied him in order to carry out this silly custom. There ought to be a heavy penalty affixed for the shearing of a mule's tail, and the law carried out to the letter. From being more emaciated by work they are less able to withstand the effects of bites by gnats, and their shaggy coats when in poor condition give the insects a better opportunity to fasten upon them. A female mule, in good flesh, with a smooth coat of hair, is by far the least liable of her kind to suffer fatally by reason of gnats.

Horses are by no means exempt from death by reason of attacks of gnats, but their condition, and the position which they occupy on the plantation, render them less liable to injury.

Among cattle, while the fatality is not so great, the loss of flesh more than makes up the deficit; besides, the beef is rendered un-

marketable for a time, and often the animal is never after fit for market. Milk, when the gnats are so extremely abundant, is unfit for use.

Swine, when seriously attacked, are often killed, or if not, are so injured and "stunted" that they are unfit for pork.

Poultry suffer in much the same manner, and while incubating are often killed outright.

EFFECT OF BITES.

No one who has once been bitten by one of these gnats will ever after, for a moment, doubt the excruciating torture which they must necessarily inflict upon dumb brutes, which, by nature, are incapable of protecting themselves. Although I can not state from personal observation, and sincerely hope I may never be able to do so, nevertheless I am told that the agonies of dying animals are faithfully reflected in the case of human victims.

The bites of a very few gnats do not appear to affect animals seriously. Mules raised upon the plantation are far less susceptible to the bites of gnats than those imported from more northern localities. It is a common notion among planters that the first gnats to appear are the most destructive, but this can hardly be true, as they may be blown about so as to appear first at different times in different localities.

When seriously bitten the animal does not always show the effects at once. Teams are often brought in at night, fed and stabled, but found dead in their stalls next morning, and it is often several hours after exposure to gnats before the animal sickens at all. On the other hand, death comes often much more suddenly. The animal will appear to be suddenly attacked with colic, a disease to which mules are very much subject, and die in a few hours. The deception caused by the similarity between the effect of gnats and ordinary wind or water colic, is so great that it is often impossible to determine what the trouble really is, and the animal is, in such cases, frequently "doctored" first for one and then the other. The precise effect of the bite is supposed to resemble very much that following the bite of the rattlesnake, and this seems to be the general opinion throughout the infested district.

REMEDIAL MEASURES.

From what has been previously stated it will be clearly observed that there is a serious lack of exact information upon two very important points, viz., how to readily distinguish between an attack of colic and the effect of the bites of gnats, when both are to be expected, and the best remedies to apply, in case of the latter, as it is not only essential that something be done, but that it be promptly done as well.

As we would naturally expect there are a great many remedies in use, all having more or less advocates, and each with a list of recommendations and cures. None of these, however, have been generally tried thoroughly, and in cases where the result left no doubt as to the virtue of the remedy. The two following receipts seem to have given the best results when used promptly:

Give liquid ammonia, one-half ounce in half pint of warm lard oil, every two hours until relieved. A teaspoonful of ammonia is often used, when it can not be conveniently measured otherwise.

Give mixture of 40 to 50 grains of carbonate of ammonia in 1 pint of whisky, every three or four hours until relieved, and at the same time rub externally with water of ammonia, to relieve irritation.

Ten drops of tincture of aconite, administered every half hour, and half-pint doses of linseed oil every hour, is another highly recommended remedy. Besides these continual doses of whisky, bleeding, and immersion in cold water, are each recommended. In two cases which came under my observation, both animals being similarly and equally exposed to attack, whisky was given and the animal kept in cool water; one died and the other recovered, although both had been treated exactly the same. The fatal case was that of a male mule, and the other a female.

PREVENTIVE MEASURES.

Since it has been demonstrated that no relief can be expected from the destruction of the insect, in any of its stages, the use of repellants is the only means left by which any degree of protection can be secured against attack.

So far smokes or smudges have proven the only harmless means of securing this end. About the fields these may be made by firing stumps, dead trees, fallen timbers, leaves, and rubbish. For use about teams, cotton-seed may be employed, rolled in strips of sacking, forming a roll the diameter of one's arm, which roll on being ignited burns slowly and produces much smoke, and may be hung about the harness. Or fires made in the bottoms of tin buckets, and the latter filled with cotton-seed and attached to the harness, also afford protection. With these work can be carried on in the fields with reasonable safety, if proper care is taken to keep them in working order, and the wind is not so strong as to blow the smoke away too rapidly. Smoke, in fact, is the only means of protecting cattle and other neat stock, but they will hover about it, frequently crowding one another into the fire, and, besides, they will starve rather than go beyond the smoke to secure food. With many planters it is very difficult to provide subsistence for stock thus confined for weeks after passing through the winter, and very often at the end of the gnat season they have only a herd of animated skeletons left, not worth the cost of keeping.

Various decoctions and substances are also applied externally to the bodies of animals, with a view of keeping the gnats away, but none of these have proven of much practical value. To be effective, applications must be made frequently, which, aside from the time required, are apt to remove the hair and obstruct the pores of the skin, either of which is very detrimental to the health of the animals.

Decoctions of the leaves of alder, pennyroyal, and tobacco have proven entirely ineffective, and powdered pyrethrum, suspended in water, of only temporary virtue. Kerosene emulsion and diluted carbon-bisulphide were no better. Fish oil is quite effective, but expensive. Cotton-seed oil, lard oil, or lard itself, is used, mixed with smaller amounts of oil of pennyroyal, oil of sassafras, or oil of peppermint; tar may also be substituted. Kerosene mixed with oils or with axle-grease, or Frazier's axle-grease alone, is also used. The grease of the alligator is said to be the best of all. A combination of oils, sold under the name of gnat oil, is used in immense quantities.*

* Messrs. Hardaway & Cassell, wholesale druggists of Vicksburg, Miss., sold about 3,000 gallons in 1882, and about 350 in 1886. Price, 30 to 50 cents per gallon.

While I have found grease of almost any sort considerable protection early in the morning or late in the evening, when gnats were not extremely abundant, I never found any substance upon which I cared to rely solely for the protection of my horse during days of great abundance, and never ventured forth without slow-matches of cotton-seed rolled in sacking, attached to the saddle, and moreover never saw a careful planter who would do otherwise.

The value of these oils and fatty substances as a means of protection may be briefly summed up as follows: For work animals only, and when protection is needed only a portion of the day, and then as against only limited numbers of gnats, they are very convenient and useful, but for these, under other less favorable conditions, or for stock running at large, they are of very slight practical value, and their excessive use is almost sure to injure the animals to which they are applied.

Blooded stock, on account of its greater value, should be confined in dark stables, this being the only absolute protection against gnats, as they will not enter such places.

DAMAGE SUSTAINED PREVIOUS YEARS.

Under this head only fatal results can be averaged, although there is but little doubt that the loss by reason of delay in plantation work, inactivity of men and teams, loss of flesh in other than work animals, and also through other causes, would overbalance the loss by death of animals. The former can not be computed, and only fragmentary facts and estimates can be obtained as to the magnitude of the latter.

Gnats have occurred in great numbers in the valley of the Lower Mississippi during the years, 1861, 1862, 1863, 1864, 1866, 1868, 1872, 1873, 1874, 1881, 1882, 1883, 1884, 1886, and 1887. The loss during the first three years was of course sustained largely by the two armies then in possession of the country. In 1866, Madison Parish, Louisiana, sustained a loss of over 200 mules, and as many more died in two adjoining parishes. In 1874, one county in Tennessee sustained an estimated loss of \$500,000. In 1882, Franklin Parish, Louisiana, within a single week, lost 3,200 head of stock. Not less than 300 mules were killed in three or four parishes of the same State the present year, and each mule represented a value of not far from \$125.

These figures do not include such animals as died from *charbon*, a disease said to be due to the effect of the bites of gnats, and particularly fatal to mules, although death may not occur for several months after being bitten.

ATTACKING MAN.

Owing to his being better protected and more capable of defending himself, man is much more exempt from attack than animals, although instances of people being bitten by gnats are not uncommon. That they will not hesitate to attack people, I have myself had experience sufficiently conclusive. In moving about among the great numbers which will collect about one's head, and especially the face, ample opportunity is offered to study their malignant nature. If not prevented they will dart at exposed parts of the body, and on striking the skin of the face, in particular, will cause a smarting sensation. The bite is very painful, and a discolored spot will often remain long after all other effects have disappeared.

Several well-authenticated instances are on record where individuals have been unable to defend themselves against the attacks of hordes of these insects, and were so severely bitten that they died shortly after in great agony.

THE EFFECT OF OVERFLOWS ON BUFFALO GNATS.

That the escape of water from the Mississippi River into those streams whose courses lie through alluvial country, and nearly parallel with itself, exercises a great influence upon the number of gnats, and consequently upon the ravages of this pest, there is abundant evidence.

Since the year 1881, every invasion of gnats, of which information can be obtained, has been preceded by a rise in the Mississippi River sufficient to affect the streams wherein the insect is known to originate, and during the breeding season of the years 1886 and 1887 the number of these pests has coincided exactly with the rise and fall of the Mississippi during March and April, which months mainly constitute the gnat season.

The overflow escapes from the Mississippi River through defective levees, or at points where no levees exist. One of these localities is between Gaines's Landing and Lana Landing, Arkansas.

Mr. Robert E. Craig, a very intelligent and observing planter at the latter point, has kept a memorandum of the occurrence of gnats since 1881, and states that he has never been troubled with the pest except when the Mississippi overflowed in his neighborhood.

In Louisiana where, since 1866, these gnats have caused so much trouble, there is no record of stock being destroyed prior to 1861, although the people were much more liable to have observed and reported an invasion of gnats had it occurred, than at present. Until 1861 the levees were kept in good shape, and no overflow-water filled the inland streams as at present. Again, below the mouth of the Red River no serious damage by gnats has been reported, and such wide-spread ravages are there unknown. Yet I am assured by both artillery and cavalry officers that from 1862 to 1865 gnats destroyed many horses and mules in the vicinity of Pointe Coupee. Levees destroyed then are now rebuilt. With so much evidence of the effect of overflow we are led to believe that when a complete system of levees shall protect the alluvial country now infested from this influx of water the occurrence of these gnats in such destructive numbers, at least, will cease. Of the truth or fallacy of this theory we shall not long remain ignorant, as during the present year a complete levee system will extend from the mouth of the St. Francis, in Arkansas, on the west side, and from Memphis, Tenn., on the east side of the Mississippi River, southward to the Gulf.

In proportion to the volume of water added to the normal supply of these inland streams is the rapidity of their current increased, thereby multiplying the number of localities favorable to the development of gnats. Such localities are influenced (1) by bringing a larger supply of food within reach of the larvæ, and (2) starting at low water each foot of rise adds to the number of objects to which these larvæ can anchor and attach themselves while passing the pupal stage, reaching the maximum in this effect during a general inundation, when the greatest destruction of stock occurs.

It would, however, at present, be too much to say that there are not other ways by which overflow affects the number of gnats.

PROBABILITY OF FUTURE INVASIONS.

If, in the future, the conditions favorable to the development of these gnats in such immense numbers remain as in the past, it is but proper to assume that the effect will be much the same. But as we have stated, it is not probable that the present state of the levees will continue even another year. Just what effect the confinement of the Mississippi River to its proper channel below the mouth of the Arkansas, in extreme high water, will have upon the St. Francis River, and the country between it and the Mississippi itself, is a problem which even civil engineers themselves can not yet decide.

If the St. Francis bottoms remain as they are now, unprotected by levees, and the current of that stream is not materially affected or changed from its present condition, there is little hope in the future for immunity from gnats throughout eastern Arkansas, west Tennessee, and northwest Mississippi in the event of high waters during March and April.

Overflow from the Mississippi River gains admission into the St. Francis through the region known as "sunken lands," in the vicinity of New Madrid, Mo. With water at 39.6 on the gauge at Cairo, Ill., the overflow first begins, and a height of 44.0 or above at the same place, for any considerable length of time, is sufficient to inundate the greater portion of the St. Francis bottoms. Hence, unless negative factors, not now known to exist, should arise and the water should remain for any considerable time, between March 15 and April 25, at or above 44.0 on the gauge at Cairo, an invasion of gnats more or less serious may be expected.

The direction and velocity of the wind, during an invasion of gnats, no doubt exert considerable influence in distributing them over the country, and therefore, with west, southwest, or northwest winds, they would be carried into west Tennessee and northwest Mississippi; while the reverse of these would carry them farther into the interior of Arkansas, and, to some extent at least, protect the former localities.

SUGGESTIONS.

From the preceding it will be clearly observed that trouble from gnats, in the future, is to be apprehended, particularly throughout eastern Arkansas and the adjacent country. For a considerable time to come the stock-raisers and the dairymen throughout a section of country of which Memphis, Tenn., may be considered the center, will be obliged to contend with this, the greatest drawback of both industries.

What these people at present most need is (1) a better knowledge of the effects of the bites of gnats on the animal system, and the best means of counteracting these effects; (2) the relation of the bites to *charbon*, and relief for this disease; and (3) some substance which can be applied externally to animals to protect them from the bites of gnats, and is not itself injurious to the animals to which it is applied. For the purpose of this, I would strongly recommend the detail of a competent veterinarian during the next invasion of gnats, whose duty shall be to study these points, and to enlighten people thereon.

LIVE-STOCK INTERESTS OF MARYLAND.

Hon. NORMAN J. COLMAN,
Commissioner of Agriculture:

SIR: My investigations into the condition of the live-stock interests of Maryland not having been completed at the close of my report for the year 1886, I have since visited the remaining counties indicated in your instructions, and herewith inclose you the results of my investigations.

MONTGOMERY COUNTY.

There are many dairy cattle kept in this county, particularly along the railroad and near the line of the District of Columbia. In other sections many stock cattle are fed for beef.

After careful inspection I have been unable to find a single case of pleuro-pneumonia in this county. I found several places where they have had the disease within the past few years. I failed to find, however, on these farms any chronic cases of the plague. I was surprised at this condition of things, and I can not account for it except on the theory that the contagion has died out here. It is possible it is only in a dormant condition and that in the near future we may have it revived both here and in Prince George's County.

Though no pleuro-pneumonia was discovered I found many cases of tuberculosis. Mr. John Stone, Potomac post-office, sent for me, thinking he had pleuro-pneumonia in his herd. I found 12 head of cattle, 4 of which were coughing. After examination I pronounced the disease tuberculosis. One of the animals had been purchased some months ago in Virginia. Mr. Stone noticed her coughing as he brought her home. Three others have since commenced coughing. At my suggestion Mr. Stone killed the Virginia cow and I made a *post-mortem* examination. I found extensive tuberculous deposits in both lungs. Mr. Stone was convinced as to the disease and has since killed the other 3 affected animals. I made another *post-mortem* on the farm of Charles C. Lenning, near Cabin John post-office. This cow was imported from North Germany, August 19, 1885, with 5 other cows and a bull. Three cows and the bull died some time in 1886, evidently from some lung trouble. Mr. R. L. Saunders, manager, killed this cow at my request. I found both lungs filled with tubercles and abscesses. Another animal of the same importation evidently has the disease, though not so far advanced. The remaining cow had been sold and I did not see her. I am satisfied there are other cattle on this farm that have contracted the disease from this imported herd.

I heard there was sickness on the farm of James Tschiffilley, Darnestown. I found that he had already reported to Dr. Salmon and that Dr. Rose had investigated the case the day before my visit.

There were 15 head of cattle and among them two bad cases of tuberculosis. These 2 were bought last December at drove-yards in Washington. They are supposed to have come from Virginia. These 2 have been coughing some months, and more recently nearly every animal in the herd is coughing. The owner refused to kill any of his herd. On this farm and the two farms above reported there was fine opportunity to study tuberculosis and to be convinced of its contagious character.

On the farm of Blair Bros., Silver Spring, I found 61 cattle of all ages. Thirty-five cows were in stable. Among these five cases of tuberculosis were clearly marked. William Laird, near District line, has 24 cows, among which are two cases of tuberculosis.

On the farm of J. W. Boyd, Boyd's Station, I found 146 cows. The stables and cows were in fine condition, but several cases of tuberculosis were found. There are many other farms where one or more cases are to be found. Cattle are generally well cared for in this county.

Epizooty among horses has prevailed here to a considerable extent, and of a severe type, several deaths having occurred within the past few weeks. On the farm of N. P. Cook, occupied by F. P. Cooper, 2 miles north from Gaithersburgh, I found three cases of glanders. I reported these cases to Dr. Ward, State veterinary officer, and by his orders I had these horses killed September 10, and made *post-mortem* examinations. One of the horses was purchased about the last week in July from one of the car stables in Washington. The horse was then ailing. Soon after this 2 horses, working in the same team, were taken sick, and evidently contracted the disease from the new purchase. All had well-marked glanders. The other horses on the farm are in quarantine by order of Dr. Ward.

For several years past the losses by swine plague have been heavy. The losses for the whole country for 1884 and 1885 reached, probably, 75 per cent., but for 1886 it was considerably less. Careful inquiry induces me to place the loss for 1886 at about 30 per cent. This, for 6,503 voters, would make the loss about \$29,263.50. In the sections bordering on Frederick County the disease is now prevailing.

HOWARD COUNTY.

Along the Patapsco River and the line of the Baltimore and Ohio Railroad large numbers of dairy cattle are kept. The milk and butter are shipped to the Baltimore market. In other parts of the county, away from railroads, few cattle are kept except for winter feeding.

Near Hood's Mills, on the two farms of the late Nimrod Dorsey, and the farm of A. P. Forsyth, there had been pleuro-pneumonia in the spring of 1886. The reports in these cases have been made by your inspectors, Drs. Michener and Wray, by whom all the cattle on these three farms were slaughtered. The stables were disinfected and several months were allowed to pass before any cattle were purchased. The cattle now on these farms have been there several weeks. I examined them carefully and found no disease. Careful investigation convinces me the disease did not go beyond these farms. I found no pleuro-pneumonia in the county.

On the farm of Thomas W. Fisher, near Sykesville, I found one case of well-marked tuberculosis, which he promised to kill at once. Generally the cattle in this county are healthy and well cared for.

No disease among horses was found. The swine plague or hog

cholera has not prevailed here generally for about two years. During 1885, and for some years before that, the losses were very heavy, amounting in 1885 to probably 50 per cent., or \$26,550. During 1886 the disease prevailed only in the third, fourth, and fifth districts, and not so seriously as in the years before. I heard of a few cases lately in the fourth district, bordering on Montgomery and Frederick Counties.

CARROLL COUNTY.

I find along the line of the Western Maryland and Baltimore and Ohio Railroads, in this county, that large numbers of dairy cattle are kept, and large quantities of milk shipped daily to Baltimore, while in other parts of the county butter is extensively made. It is one of the richest grazing counties in the State. Many stock cattle are also fed here during the winter.

In view of the importance of the cattle interests of this county, and of the fact that it is under the ban of quarantine from your Department, I have taken the greatest pains in making my investigations. I have visited every neighborhood, and where there was the slightest suspicion have examined every stable and animal. I have not been able to find a single case of pleuro-pneumonia in the county. In the neighborhood of Smallwood and Bird Hill, where disease was found in 1886, and cattle were destroyed by Drs. Michener and Wray, I made very careful investigations. I find that these gentlemen effectually stamped out the disease from places where it existed by killing affected and exposed stock. On the farm of W. H. Westoway, near Patapsco, I found all healthy. On this place, in 1882, pleuro-pneumonia was found by Dr. Le May, State veterinary officer. Dr. Le May killed all affected animals. Mr. Westoway says the disease was brought to his place by a cow bought in Hanover, Pa. The disease did not spread beyond this farm.

I find in this county, particularly among dairy cattle, many cases of tuberculosis in its various forms and stages. In a few instances animals have been destroyed by my advice. There seems to be much interest taken by the farmers generally in this disease, and a desire for more thorough investigation and legislation.

Some few cattle died from Texas fever in August last, on the farms of Lewis Cash and George Dorn, near Middleburgh. These deaths occurred among steers just brought from Chicago. The disease did not spread to other stock, though other cattle were exposed.

Horses throughout the county seemed healthy.

The farmers have suffered here for many years from the ravages of the swine plague. Formerly immense numbers of hogs were raised in this county, but, because of this disease, there are now not one-fourth as many raised as before the disease was known.

The lowest estimate given me as to the losses for last year was 20 per cent. There are in the county 7,984 voters. I think there are usually here 3 hogs to a voter, amounting to 23,952, and at \$5 per head would amount to \$119,760, value of usual hog crop. Twenty per cent. of this would be \$23,952, the estimated loss for last year. My impression is that this is a low estimate for the actual loss by deaths. It is hardly possible to estimate the loss to the county because of the failure to breed hogs for fear of the disease. There is now some disease in the county.

FREDERICK COUNTY.

This is one of the largest counties in the State, and next to Baltimore County it has the largest population. The soil is perhaps better adapted to stock raising than any other part of the State.

For many years past much attention has been given to the feeding of stock cattle. The farmers say this has of late become unprofitable, and this year comparatively few beef cattle are to be found here. Creameries are, however, springing up in all parts of the county. Ten are already established, and as many more are likely to commence operations during this year. Thus the stock in cows is rapidly increasing, several hundred having been brought into the county during the past year. It has taken considerable time to examine these dairies carefully. The cows have been purchased in Virginia and Pennsylvania and other counties of Maryland, and are mostly of common stock. There are a few good herds of Shorthorns and Jerseys. Moderately good care and attention are given to cattle.

Careful investigation convinces me that there is now no pleuropneumonia in this county. In one or more instances the disease appeared here a few years ago, but it was immediately checked by slaughter of all exposed stock, and it had no chance to spread.

Tuberculosis is frequently found here as in other counties. One herd of 6 cows, owned by John H. Haugh, near Bartonville, were all badly affected with this disease. I learned from others, and from Mr. H. also, that for ten years past he has frequently lost cows affected similarly. Many other herds are more or less affected with this disease. Such cows are kept generally through ignorance of the danger. It would be well if owners could be shown the importance of destroying all such diseased animals. I think quite evidently this disease is on the increase here, and considerable of it has been brought in from other States during the past year.

Another infectious disease prevalent here is abortion. It is to be found in many stables and in nearly every district. It has caused extensive losses to the farmers. It is evidently on the increase, and it is the subject of constant discussion among the dairymen. It is here thought to be the most serious disease among cattle they have to contend with.

More thought and attention have been given to the breeding of horses than cattle. Several fine breeding farms in different parts of the county have on them some of the best stock in the county. On these farms, and everywhere else, I found the horses free from disease.

The swine plague has prevailed here for several years. For three years past the losses have been very heavy. In some districts in the southern part of the county few hogs are now raised because of disease. Everywhere in the southern part of the county the farmers estimate the losses annually at 75 per cent., while in the northern part it has been much less. It has been difficult for me to form a correct estimate of the loss for the whole county, but no one has put the loss below 50 per cent. for the whole county. Considering, however, the danger of over-estimating the loss by the farmers, I put it at about 40 per cent. Taking the 12,106 voters at 3 hogs per voter, we have 36,318 hogs, and at \$5 per head we have for this county \$181,590, the value of the usual hog crop. Forty per cent. of this would make \$72,636, the amount of the annual loss for the last three years. In this estimate I feel sure I am within bounds.

WASHINGTON COUNTY.

There is no pleuro-pneumonia to be found in this county, nor could I find any evidence that this disease has ever been here. Large numbers of cattle are shipped and driven through this county from the Cumberland and Shenandoah Valleys, and vast numbers of beef cattle are fed here during the winter. The dairy interest is not large, though in the northeastern section of the county many cows are kept and the milk sold to a creamery in Waynesborough, Pa., just over the line. The cattle in the county are as healthy as any found in the State, though tuberculosis prevails to some extent. On the farm of David Gossard, Ash post-office, a few calves were lost in December and January last. Careful inquiry leads me to believe the disease was anthrax. The 9 head of cattle now on the farm are healthy.

I learned that about one year ago several cattle died on the farm of Mr. Huffer, about 2 miles from Chewsville. Mr. Huffer says he lost 13 head of cattle, 2 horses, and 6 sheep, while two other men near by lost 2 cows each. This trouble was hidden at the time, fearing, as they said, that if it were known the State would destroy all exposed cattle without compensation. Careful inquiry convinces me that this disease was anthrax also. The cattle on this farm and in the neighborhood are now healthy. The people are now better informed as to the laws and policy of the Government and State, and any outbreak of disease would be reported to the authorities.

No disease among horses was found. Hog cholera had for many years been very fatal here, less so in 1887 than for several years past. In 1885-1886 vast numbers of hogs died. Many farmers told me that comparatively few hogs are now kept because of the prevalence of this dreaded disease. Many estimate the loss in 1886 at 75 per cent., and none estimate it at less than 50 per cent. The number of voters registered in 1886 was 9,595; 3 hogs per voter would make 28,785, and at \$5 per head would make \$143,925 as the value of the usual hog crop. Fifty per cent. loss would make \$71,962.50. This I feel sure is not too high an estimate.

It seems to be the general opinion here that there should be a State law compelling the burial or destruction of all dead animals to prevent the spread of contagion.

Respectfully submitted.

F. W. PATTERSON, M. D.,
Inspector, Bureau of Animal Industry.

BLACK LEG—ITS SYMPTOMS AND TREATMENT.

This disease occurs most frequently in young animals, those from six months to two years old being most subject to it, although older animals are not exempt. It is most common in the spring and summer season, particularly if the animals have been reduced by bad keeping and scanty food during a long and severe winter, and are turned upon rich pastures where they gain rapidly in flesh from an abundance of good food. It usually attacks first the thriftiest and most promising animal of the herd. It develops and kills its victim so quickly that often the first indication the owner has of any trouble is to find the finest of the flock dead in the field. If noticed in life the following symptoms would be observed: A vague and listless expression; ears drooping; pulse irregular, feeble, and rapid; mouth hot and dry; conjunctiva (lining membrane of the eye) very red from congestion of the membrane; halting on one limb; stiffness, and excessive tenderness of some parts of the skin. Very soon swellings appear upon the loins, back, neck, head, brisket, or upon one or more of the limbs. These swellings become firm and tense, with yellow or bloody liquid oozing from the surface, and crepitate (crackle) when pressed. Later they become insensible and even cold, and may finally slough open, leaving large, unsightly, and inactive sores.

The animal shows an unwillingness to move about, remains by itself away from the rest of the herd, and if it lies down is unable to rise. The appetite is entirely lost, rumination suspended, bowels inactive or torpid, urine scanty and high colored, sometimes dark or coffee colored. The animal loses strength rapidly, maintains the recumbent position, is unconscious, eyes protruding and sightless, and dies in coma, or from sheer exhaustion often within twelve hours after the first manifestation of lameness.

The swellings under the skin contain serum and extravasated blood that decompose quickly after death, forming gases that puff out the skin and give the body a bloated appearance, hastening putrefaction. Black exudations of blood form extensive patches, which may be confined to one limb or quarter. Similar exudations occur between muscles that are gangrenous, and the blood vessels in that region are full and rigid, though the blood is dark and fluid. The lungs are congested, the lowest being the worst; frothy mucus almost fills the bronchial tubes, and extensive ecchymosis (blood stains) covers the serous membranes. The heart is soft and flabby, and filled with blood that is black and semi-fluid. The rigor mortis is very slight, and observed only immediately after death.

In some cases there are premonitory symptoms of some disease before the aggravated symptoms are developed. Thus, in a herd where one or more deaths from black leg have occurred, others are found which are not doing well, are hide-bound, the skin looks unthrifty and is covered with scurf and a rough, staring coat of hair. All the movements are made stiffly with arched back, and with apparent effort or even pain. There is a capricious appetite, irregular rumination and bowels, and the urine scanty and high colored.

Animals so affected can usually be benefited by medicinal treatment, but if neglected and the disease is allowed to go on it assumes a form in which no good can be done by giving remedies.

Antiseptic saline purgatives are the first remedies indicated, such as 1 to 2 pounds (according to the size of the animal) of Epsom salts (sulphate of magnesia), or Glauber's salts (sulphate of soda). Dissolve in water; add $\frac{1}{2}$ ounce of ginger and about $\frac{1}{2}$ pint of molasses to the solution, and drench each animal. This may be followed in six hours by a dose of spirits of nitrous æther 1 ounce, and compound tincture gentian 1 ounce, mixed together in half a pint of water and repeated every six hours. If the patient is not greatly depressed or exhausted 1 to 3 drachms of potassic chlorate dissolved in water and given three times a day may be used instead. Exercising the animals by driving them, to keep up the circulation and prevent congestion, is recommended.

The local swellings may be fomented with hot water, to which a little ammonia has been added, and painted with compound tincture of iodine in the intervals between the water application. A cloth wet with the following solution may be placed over the affected parts, viz., iodine, 40 grains; iodide of potassium, 80 grains; water, 8 ounces; or this solution may be injected hypodermically into the swellings, using a sufficient quantity to entirely saturate the contents. Scarifying or lancing the skin where swollen is not recommended, since it causes large unhealthy sores that do not heal readily and make unsightly blotches. Very fat, plethoric animals should be bled a few quarts of blood from the jugular vein, but upon weak and exhausted subjects this operation should not be performed.

Since black leg is so suddenly fatal, precautions against the spread of the disease and against its development are of much greater value to the stock-raiser than any other course of procedure. Sudden accessions of plethora are to be avoided, and a steady gain in condition must be accomplished in localities where the disease is known to prevail. Remove cattle from infected pastures, especially those that are low, swampy, and undrained. Provide pure drinking water, and prevent drinking from stagnant pools of surface water. Separate the diseased from the healthy. Burn or bury deeply every diseased carcass, and disinfect sheds, yards, or stables where diseased animals have been kept. Shelter at night and secure shade trees in the pastures where there is an extreme difference between the day and night temperature, especially after and during a hot season accompanied with an abundance of rain and dampness.

Additional preventive measures that have been found successful are to give every animal each day powdered saltpeter and flowers of sulphur, mixed in equal parts, and to insert a seton smeared with tincture of cantharides or oil of turpentine in the dewlap of each. Warm, well-ventilated stables, situated upon high, well-drained ground; are of the first importance in order to maintain good health in a herd; also sound, easily-digested food, given regularly and in proper quantities, should be observed. Tonic medicines, such as preparations of iron, gentian, and quinia, will be found valuable.

EXTRACTS FROM LETTERS OF CORRESPONDENTS.

VARIOUS DISEASES.

On the 2d of January, 1887, Mr. D. W. G. Benbow, Greensborough, N. C., wrote as follows concerning a disease then prevailing among his horses and mules :

I have a lot of mares and colts, six months of age and one and two-year-olds. I have a large stable, weather-boarded, sash and glass to give light, with one weather-boarding off of two sides, which is closed during cold spells. Two weeks ago one of the mares in foal quit eating and seemed to have no use of her hinder parts. We helped her up but she was unable to stand. She lay for two days and died. Upon opening her, all the organs seemed healthy except her kidneys, which were black, terribly congested, and almost rotten. There was considerable water in her bladder. There was but little food in the stomach, as she had eaten very little for a few days previous to her death, but the stench from the carcass was terribly offensive. Some of the other animals seemed to be improving, but at the same time another mare *not* in foal quit eating. There was an effusive issue of matter from the nose unlike that discharged in distemper, but had more the appearance of half-digested wheat straw. She lingered only a few days. She went to water last Sunday forenoon, but seemed unable to drink, yet appeared to want water. She then walked to the rear of the lot, lay down and died, in a few minutes without a struggle. Upon opening her we found the lungs a mass of corruption—rotten, greenish inside, and covered with slime and mucus. The texture was of no strength whatever. The inner wall or lining tissue of the ribs looked as though it had sloughed off. In pressing open the carcass all above the diaphragm seemed rotten and would break without effort. Before death the animal vomited like a dog, raising a white, frothy, greenish-tinged substance, which I thought had been swallowed and caused nausea. Last Wednesday six more animals showed symptoms of the disease. I sent 24 well ones out to another farm, where the quarters are not so good, and they will there be exposed to severe weather. Last night a one-year old colt died. Examination developed some of the conditions of the last mare described. The stench from this animal was simply horrible. I have fed these animals on ensilage, meal, bran, wheat ground up and corn on the cob, with wheat and rye straw cut before it was ripe and cured for dry feed. My cows are fed on the same, with the exception of corn in the ear, and seem to do well on it. I am feeding only hay to the horses I sent off to rough it. I already had there 40 yearlings, a mare and 5 mule colts six months old, which had been fed on hay, and all were looking well.

Mr. M. Erskine Miller, Staunton, Va., writing under date of January 10, 1887, says :

I recently lost a fine young bull only fifteen months old. He seemed to have indigestion two days before he died. I was away and did not return until after he had died. My herdsman informed me that he noticed two weeks before he died a swelling on top of his loins, which would rise and fall, and which he did not think much of as the animal appeared to be in good health and took his food well. He died December 25. Yesterday we discovered a young cow slightly swollen in the same place. She seemed in good health and doing well. She calved in August, and the past month has increased in her milk. She is a little tender over the swelling in the loin. To-day it seems better, or not so much swollen. When the bull died he was very much swollen, as if suffering with bloat. I sent his carcass to a fertilizing factory, and they reported his kidneys as very soft, and in their judgment very much disorganized, but as he died forty-eight hours before they opened him I thought the condition of his kidneys was due to the length of time that had elapsed before the examination was made; but since the swelling in the young cow at the same place I have felt uneasy lest it may be something serious. I opened a silo on the 6th of December, and I am not altogether satisfied that it is

healthy food. A very strong smell of acid pervades the atmosphere about the silo. Could this ensilage have anything to do with the symptoms in these cattle? Every thing about the place eats it ravenously.

Mr. Frank Gilmer, Charlottesville, Va., writing under date of January 25, 1887, speaks as follows of a cutaneous disease affecting his hogs:

Sometime last fall I bought a couple of thoroughbred Poland-China pigs of a neighbor, and a day or two after I got them my manager found them covered with small scabs from the size of a pin's head to that of a twenty-penny nail. They seemed hearty, and after several washings with carbolic soap got well; but in the mean time my two brood sows broke out the same way, and their pigs came much too soon, and were dead when born. I have been told by some that the disease is the measles and by others that it is the cholera. I never had any disease among my hogs before. The animals have all recovered, and are now in pretty good health.

In the latter part of January, 1887, Mr. William M. Moran, Gilford, Loudoun County, Va., informed the Department that a very fatal type of pneumonia was prevailing among horses in that county.

Mr. S. S. Aiken, Deskins, Jackson County, Oregon, under date of January 29, 1887, writes as follows concerning abortion among cows in that locality:

I inclose you a sample of pine moss, which is quite abundant on pine trees in many localities along this coast. Cattle eat it eagerly at all seasons, no matter what their condition or however good the pasture may be. However, they can get but little except when it is provided for them by felling the trees, which is often done to save stock during a hard winter after all other feed has been exhausted. Many stockmen believe the feeding of this moss produces abortion. I have noticed that abortion often occurs, but I have attributed it more to the poor condition of the cows than to the moss eaten by them.

Mr. Leander Woods, writing from Nashville, Brown County, Ind., under date of May 8, 1887, gives the following description of a disease affecting horses in that locality:

There is a disease now prevailing among our horses which has proved fatal in some cases. I am not able to give much of a description of the disease, as I have seen but one animal suffering with the malady, and it was in the first stage. It finally died. From the best information I could get I would say that the disease resembles diphtheria. The throat becomes very sore and swollen, and before death a stiff corruption gathers around the root of the tongue, or at the hinge of the jaw. In the case I saw, when they thought the animal was dead, they opened the side of the jaw and about a quart of stiff corruption ran out. The horse seemed better for awhile, but died in about three hours.

Mr. T. J. O. Morrison, New Madrid, Mo., under date of June 30, 1887, writes as follows concerning diseases affecting cattle, horses, and mules in that locality:

Some time ago I addressed a communication to the Rural World relating to a strange disease that had developed among cattle in this section of Missouri. Since then this disorder has taken a new form, or a different type of disease has taken its place, which, though not as yet so fatal, is almost as serious in its results. It first makes its appearance in a slothful manner, or indisposition to move, followed by a vacant stare and glassiness of the eyes, which is soon followed by blindness, sometimes total, but more frequently of one eye. The animal appears to have fever, with loss of appetite and shrinkage of flesh. Many persons abstain from the use of milk, fearing this malady may have some relationship to "milk sickness," although the affected animals present none of the usual symptoms of that disease. The disease first made its appearance about the 1st of June. I first discovered it in a young calf which refused the udder, and began drooping and lying around, manifesting great indisposition to move. This continued two or three days when the calf died, whilst a few days later another, afflicted in the same way, recovered and is now apparently well, except its sight, which remains very much impaired. This disorder is becoming general in this neighborhood, nearly half of some herds being afflicted with it. Various causes and remedies are suggested and discussed, but none appear satisfactory or of sufficient credit to be generally approved. The cause

of the disease is as yet undiscovered, and although many remedies have been suggested none of them have proven effectual. Perhaps the most successful yet tried is a solution of common salt and sulphate of zinc. Wash the eyes with this solution twice a day for a few days and the white or milky appearance of the eye will disappear and the sight again become clear, if the case has not been of too long standing, in which event the film that covers the sight becomes toughened, when nothing but the knife would seem sufficient to remove it.

There is greater mortality among stock of all kinds in this county than has manifested itself for many years past. The fatality among horses and mules has been alarming. At first it was attributed to the ravages of buffalo gnats, but after these pests subsided the mortality continued. Next cattle commenced dying with what I term heart disease. The heart becomes greatly swollen and inflamed and filled with live parasites. This inflammation continues until the circulation is stopped, when the animal dies. This malady was succeeded by this affection of the sight, the cause of which is the subject of this inquiry.

DISEASE AMONG CATTLE IN MINNESOTA.

In October, 1887, Dr. James Law, chief inspector of the Bureau at Chicago, visited Minnesota for the purpose of investigating the cause of a mysterious and fatal disease said to be prevailing among cattle in Steele County of that State. He was unable to reach any definite conclusion as to the cause of the disease, as will be seen from the following report:

1. On the bottom lands of the Cannon River branch of the Mississippi, and about 5 miles north of Red Wing, Minn., Mr. Rodman has lost 8 cattle—one and two-year-olds—out of a herd of over 50. I found 1 yearling dead with no apparent lesion beyond venous congestion around the stomachs and a black, fluid condition of the blood in the larger vessels. In the heart were firm, black clots; spleen sound. In the blood I found staff-shaped bodies $2\frac{1}{2}$ times the breadth of a red globule, and groups of refrangent spheroids, but as the bottle in which it had been carried had been only rinsed out with hot water and not sterilized I dare not attach much importance to this. Dr. Hewitt proceeded to extract any alkaloid which might be present in the gastric contents, but I have not learned the result. The lesions would not be altogether incompatible with a rapidly fatal bacteridian poison.

The bottoms on which these animals pastured are in the main sandy and dry on the surface, but at intervals there are depressions, indicating former water-courses, soft and miry at some points and at others containing stagnant pools, with brownish black water and covered by *confervæ*.

2. In Steele County I visited the herd of Mr. Fred Ahren, at Havana, and found that since our visit in July he had lost 3 cows, 2 steers, and 2 calves. It was alleged that the disease had spread from this herd to adjacent farms, but I found that the herds of neighbors, pastured on the same swamp, had not had a case of sickness, and that the nearest cases were 2 cows at $1\frac{1}{2}$ miles distance in a straight line, with no water shed from Ahren's land towards theirs, with no possibility of contact, and with a number of intervening herds in perfect health. This suggests the swamp on Ahren's home farm as the true cause of the trouble. The common pasturage was at some distance.

3. I visited Mr. W. C. Leib, in the town of Pratt, Steele County, 5 miles south of Owatonna and $1\frac{1}{2}$ miles from Ahren's, whose herd was alleged to have been infected by Ahren's cattle. I found that he had early in the spring bought a cow of Mr. E. F. Degener, of the town of Somerset, and $1\frac{1}{2}$ miles southwest of Leib's pasture. This cow became sick in September, had yellow nasal discharge, watery eyes, an infrequent cough; blood-streaked excrement and bloody urine passed whenever the animal rose. She died in six or seven days. A second cow was said to have become blind prior to death. The pasture, in which but 1 cow is now left, has a nearly dry pond in the center, which had covered quite a wide area prior to the drought.

4. My next objective point was Mr. E. F. Degener's, over a mile southwest of Leib's place, and in the town of Somerset. He had turned out 12 yearlings and 8 two-year-olds, on May 4, on a common pasture owned by Mr. Holmes, at Geneva Lake, 8 miles south; 1 yearling died there June 11, and throughout the season all 12 of the yearlings died, the last on July 6 or 7. All the two-year-olds escaped, as did all the cattle kept at home. Hermann Wrede, one of his neighbors, turned 30 head out on the same pasture and lost 2, the only yearlings he had. Two other neighbors, Ed. Starte and M. D. Whitman, turned 3 each on the same pasture and lost none. Hermann Gretzmacher also turned on 3 and all escaped.

Mr. Degener saw only one of the sick yearlings. This one he brought home and finally killed. Its bowels were regular and urine of a natural color, but it discharged very freely from nose and eyes, and the latter were habitually hidden by the protruded brow.

The pasture occupied at Geneva Lake was partly of cultivated grasses and partly natural. It contained a number of wet spots. I could not find that cattle had died in this pasture in former years. I will add that the whole country south of Owatonna is dotted with basins having a subsoil of clay or other impervious material, and causing a slow and often imperfect disappearance of the rain-water by evaporation. Hence there is an endless succession of lakes, ponds, and swamps, and the drying of these in such a season as that of the past summer leads to the exhalation of deleterious materials, the products of the life of bacteria and allied organisms. The manifest absence of infection from animal to animal suggests that the organisms do not propagate themselves in the animal body, but that the victims are poisoned by products already formed in the soil. The symptoms, however, indicate that there may be more than one disease, and hence the anxiety of Dr. Charles N. Hewitt for a bacteriological investigation is reasonably well founded. While the grand remedy is drainage, the conformation of the land is such that we can not expect this to be accomplished soon by the ordinary method, and so long as the present state of things continues, not only will the existing diseases continue and increase with the increase of herds, but other disease poisons that are preserved in close, wet soils will infallibly be implanted and spread. In the matter of drainage I have advised boring into a porous subsoil as the most feasible method in many cases; and where it can not be safely done without superinducing disastrous droughts, to dig a deep pond in the center of the basin and thus at once secure good drinking water and do away with swamp.

SOUTHERN CATTLE FEVER.

In October, 1887, Dr. Ed. R. Allen, of Kansas City, was directed to proceed to the range of the Washita Cattle Company in the north-east corner of the Texas Panhandle and investigate the nature of a disease among cattle belonging to that company. He arrived there on the 17th of that month, and on the following morning began a careful search of the range for animals suffering with the disease, and for cases for *post-mortem* examination. He gives the following report of the results of his investigation:

Plenty of carcasses were found (I saw more than 50), but as death had resulted in all these cases from a few days up to three or more weeks previous they were not considered satisfactory for *post-mortem* purposes. A three-year-old bull was at last found suffering with the disease. The symptoms were loss of appetite and constipation, the feces being dry, hard, and dark-colored. He presented a gaunt appearance, was scarcely able to stand or walk, and voided a small quantity of bloody urine. Trembling in the hindquarters and general weakness were very perceptible. Temperature registered 106° F. A four-year-old cow was next examined, and the symptoms were very similar to those described above, except there were no indications of high-colored urine. Temperature 104½° F. My diagnosis in both these cases was splenic or Texas fever. In the afternoon we found a three-year-old cow which had been dead perhaps fifteen or eighteen hours, upon which a *post-mortem* was made, showing the following lesions: Spleen nearly twice its natural size, considerably discolored in patches and almost entirely reduced to a pulp; gall-duct very much distended with a thick, dark-colored, lumpy substance; considerable abdominal impaction of the manifolds. On the morning of the 19th instant we found a seven-year-old cow that had not been dead more than an hour or two—was yet warm. *Post-mortem* examination showed gall-duct to be very much enlarged and full of a thick, reddish-yellow, lumpy matter; the surface and cut surface of the liver presented a peculiar copper-colored appearance; spleen enlarged and more or less discolored; tissue partially broken down. In the afternoon we made a *post-mortem* on the cow that we had seen alive on the previous day, she having died a short time before. Spleen very much enlarged, spotted over its entire surface; congested; tissue partially broken down; contents of gall-bladder very similar to those previously examined; liver copper-colored. The bull, which was examined on the previous day, being considered in the last stages of disease, was now slaughtered for *post-mortem*. Spleen more than twice the ordinary size; gall-duct very much distended with a thick black substance; considerable impaction of the manifolds;

urinary bladder very much distended with bloody urine. (The last-named condition was entirely wanting in the previous cases.) Feeling entirely satisfied as to the nature of the disease, considering it beyond question an outbreak of splenic, Texas, or Southern cattle fever, I ceased my investigation and returned to Kansas City.

Early in June, 1887, inspector W. H. Rose was directed to visit and examine a herd of cattle belonging to Mr. C. E. Powell, near Leesburgh, Va., reported to be suffering with Southern cattle fever. The following report gives the results of his investigation:

I found 50 head of cattle on Mr. Powell's place, subdivided into small lots, and kept separated by fences. On examination 3 steers and 2 cows were found to be suffering with Texas fever, and I was informed that 1 cow and 1 steer had died of the disease on the 12th and 13th instant, respectively. On the day of my arrival Mr. Powell claimed that the sick cattle were getting better. To-day I tried to have a cow killed for the purpose of *post-mortem* examination, but Mr. Powell refused to slaughter the animal unless the Department paid him for it. He seemed to think very hard of me because I would not consent to purchase his entire herd. I saw no immediate chance for the death of one of the afflicted animals, so I returned without further investigation. Mr. Powell is a live-stock dealer, and ships fat cattle to the Washington market where he sells to the butchers. He occasionally purchases poor cattle from the markets and ships them to his farm, and afterwards sells them to the farmers of Loudoun and adjoining counties for the purpose of fattening. The means of infection in this instance, however, I think may be explained as follows: About two months ago Texas cattle were driven over the roads from the railroad station to a farm near Mr. Powell's farm. Mr. Powell's stock passes over this road very often. The owner of these cattle has a ranch in Texas, and he intends to ship Texas cattle to this part of Virginia during the cold months of each year.

In August, 1887, Dr. James Law, then chief inspector of the work for the suppression of contagious pleuro-pneumonia among cattle in Cook County, Ill., investigated an outbreak of Southern cattle fever in a herd located in Elkhart County, Ind. His report, giving the results of this investigation, is as follows:

In consequence of a report in the Chicago Tribune for August 10, of pleuro-pneumonia in Jefferson Township, Elkhart County, Ind., I went the same evening to Elkhart, and proceeded next morning to Goshen, near which, I was informed, the cattle were dying. A few miles east of Goshen I reached a large marsh, like a veritable oasis in the parched desert of the general country, and yet the scene of the mortality. This marsh, owned by Rockwell and Rowell, had been rented for pasturage to Fuller Bros. and others of the neighboring farmers. Pursuant to this Mr. Morse, one of the lessees, put in 7 head of cattle April 1, which remained healthy until August 3, when the first sickened and died; a second died August 11, and a third was in a dying state, the latter 2 being covered with the Southern cattle tick. Two head he took home July 11, where they are still well and with no ticks. Two he sold in July to be slaughtered. Fuller Bros. put in three car-loads of cattle from Chicago stock-yards in the first half of June and left them till August 4, when nearly all the survivors were sent to slaughter. They could not recall the number they had buried. Mr. Lehman, another lessee, had put in 9 head, one of which "gaunted up" in the middle of July, but gave her full complement of milk for a week later. She died August 1. Lehman lost 5 head and had 4 more sick in his barn, to which he had removed them. Bartholomew put 5 in the marsh and lost 2. Miller put in 7, but removed 6 in the middle of July and saved them. The 1 left in the marsh died. All the sick cattle were covered with ticks. A large portion of the east side of the marsh was fenced off and pastured by 15 cattle owned by Mr. Burnham, all of which kept well. On the opposite side was a large stretch of the marsh, pastured by Mr. Fuller's 25 cattle, all of which were healthy. This was separated from the deadly portion by a deep miry ditch into which no beast dared venture. Just beyond this was another portion separated by a fence from the infecting portion and pastured by 40 to 50 Jerseys in sound health.

In a ditch alongside Burnham's fence was an artificial pool full of dead grasshoppers and deeply stained by their excretions. Elsewhere was a ditch with running water drained from the marsh.

I made a necropsy of a Jersey heifer just dead and quite warm, and found all the lesions of Texas fever well marked. I may note particularly a general yellow

hue of the tissues, which are normally white, rising to an extreme orange around the kidneys; abnormally large, gorged friable spleen, bulging in rounded swellings in its thicker end, and, when torn, like black-currant jam; liver friable and of a deep yellow hue; gall-bladder full of a thick inspissated tarry bile; urine of a deep yellow, and quite red when seen in quantity; petecchiæ on the bladder, kidneys, mesentery, omentum, pleura, pericardium, and endocardium; a portion of the left lung carnified, and on section presented considerable recent exudation filling the interlobular tissue as well as the pulmonary, and not yet coagulated; impaction of the third stomach and some ecchymosis of its leaves: deep port-wine congestion of the folds of the fourth stomach. The blood fluid, when the carcass was opened, soon coagulated into a moderately firm clot.

I have been thus particular because the State veterinarian, who visited the place August 10, had pronounced the disease "*splenic apoplexy*." That it was Texas fever is evident from the necropsy, but is also fully borne out by the presence of the ticks, most abundant on those fatally attacked, and absent from those that escaped (that had not followed the trail of the Southern cattle), by the proved wholesomeness of the pasture until the Southern cattle arrived, by the appearance of disease one month after their arrival (the usual incubation of Texas fever), and by the immunity of all cattle removed from the marsh before the advent of the Southern stock, or shortly after that event.

After consulting with Dr. Irwin, of the local board of health, as to sanitary measures, and especially the seclusion of the infected portion of the marsh from all bovine animals for this season, and obtaining a promise from the Fuller Bros. that they would make good the damage done to other herds, I returned to Chicago Thursday night, August 11.

SUPPOSED ERGOTISM AMONG CATTLE.

Mr. Emory A. Prior, Cuyahoga Falls, Ohio, addressed the Department the following letter in October, 1887:

Among us certain farmers have of late been growing and feeding largely of corn-stalks, with the double purpose of producing a good flow of milk and greater cheapness of the ration. They have been reasonably well satisfied upon these points, but the following exception must be taken to the general success of the plan: One large dairy, varying in size from 25 to 40 cows, but containing of cows, heifers, and calves probably 50 animals, have been fed freely of corn-stalks each winter for three years past. This summer there appeared symptoms that the cows were not thriving. Although food was abundant (pasturage and feed), some of the cows became sore-footed, stiff-jointed, or dried up milk, and later some 7 or 8 cows prematurely dropped their calves. The owners are of the opinion that the cattle were poisoned with smut that is so common upon the corn-plants about here. Their pastures were under-stocked early in the season (1887), and much of the timothy grew up and matured and was afterwards eaten, during a drought, by the cattle. I wish to inquire whether you think smut dangerous to cows when abundantly present upon stalks fed to them. If it is injurious, what are the symptoms and the remedy for cattle suffering therefrom? Do you think corn smut, timothy smut, and oat smut have the same effect upon the uterus of animals as ergot? It is of no small importance to us to know the extent of the danger of thus injuring our dairies by feeding smutted corn. We have opinions from scientists that seem to be opposite regarding the use of this smut, one saying "dangerous," another "not dangerous except negatively, being no nutriment therein."

Dr. Salmon, Chief of the Bureau of Animal Industry, replied to the above inquiries as follows:

The question of the effect of corn smut on the health of cows is a very interesting one, but the facts bearing upon it are not very definite, and appear to vary from year to year. I am not clear from your statement whether the cows had been fed corn for a short time previous to the appearance of the disease and during its progress. If not, I doubt very much if the corn smut had anything to do with it. In other words, I do not believe that corn fodder fed last winter would affect the health of cows so long afterwards. As you speak of animals pasturing where timothy had been allowed to go to seed, and also refer to the timothy smut, it has occurred to me that the trouble might be due to eating ergotized timothy. I have never seen true smut on this grass, but have frequently seen it affected with ergot. Corn smut, while a different fungus from ergot, has more or less the same principles, but judging from facts which have come under my observation the active principle varies greatly from year to year, and never exists in the same proportion as in true ergot.

The most frequent effects of corn smut are indigestion and impaction of the stomachs. I have never been able to trace sore feet, stiff joints, or abortion to feeding on corn smut. I have no facts bearing on the effects of oat smut, though this is similar to the smut of corn.

In September, 1888, a disease supposed to be ergotism was reported as prevailing among horses and cattle in Pine County, Minn., and the Department was requested to send a veterinarian to the locality of the outbreak to make an investigation and give such advice as the nature of the disease might call for. Dr. Bower Talbot, of Galesburg, Ill., was directed to make the examination. The results of his investigation into the cause of the outbreak are given in the following report, bearing date of September 24:

According to your request, conveyed to me by telegram on the 15th instant, I took as early a train as possible from here for Red Wing, Minn., to the office of Dr. C. N. Hewitt, secretary of State board of health. After a consultation with Dr. Hewitt as to the quickest and best way to reach the locality where cattle and horses were supposed to be suffering from ergotism, I took the earliest train for St. Paul, and from there to Rush City, Pine County, Minn. From this place I drove to the house of Mr. George Doremus, and made known to him my mission. He very kindly consented to accompany me to the different farms where cattle were known to be sick.

After visiting about fourteen different farms and carefully examining the cattle and horses, I failed to find ergotism or any contagious or fatal disease, but I found that both cattle and horses had been suffering from some vesicating agent in their food, grasses, etc., on the low woodland pastures. None had in the least degree suffered on tame grasses on upland pastures; neither could I trace any fresh cases occurring after the 13th instant. I may here mention they had in Pine County, on the night of the 12th instant, a very heavy frost, destroying vegetation to a very considerable extent.

Cattle when first taken sick commenced to show considerable saliva, which gradually increased in quantity, followed by a smacking of the lips; the tongue in a few hours commenced to swell, and in consequence of the inflammatory action they were unable to eat anything. I found no constitutional disturbance, neither could I learn that any had been shown. No diarrhea, or lameness in either fore or hind feet, or ulceration in any of the different parts of the body. About forty-eight hours after the first symptoms were noticed the mucous membrane of the tongue, and in some instances roof of the mouth and lips, commenced to slough off, leaving the more sensitive parts bare but in a healthy condition; no signs of ulcers were shown. In a few days these parts became less swollen, the pain left, and the animals commenced to eat as though nothing had occurred. The quantity of milk was but little diminished. It had no bad smell or characteristic signs of being in any way affected, and although the majority did not use the milk for family use, they gave it to the young stock without bad results.

Horses when first taken showed very similar symptoms, excepting the lips and nose commenced swelling very considerably, and far in extent to that shown on the lips of cattle. After about fourteen hours small blisters would show themselves on the outer surface, which were soon covered with a yellow crust, and on the following day blisters showed themselves on the inner side of lips, gums, etc. Soon afterwards the mucous membrane commenced to slough off, leaving the same healthy appearance as in cattle, the animal recovering in about the same time—ten days.

These animals, as I have previously stated, were all pastured on low woodland pastures. Not a single instance of disease could I trace where cattle and horses were pastured on tame cultivated grasses, or had been kept on different feed.

Whether this trouble was caused from fungi or not I am not able to state, but I am very confident the food was the sole cause of it all, for when the affected animals were taken off these pastures, and placed either in stables or on tame grasses, the disease disappeared almost spontaneously.

I can account for horses showing blisters on the outside of the lips, nose, etc., and cattle not doing so from the fact that when feeding cattle always have much more saliva on the lips, and frequently lick their nose, lips, etc., consequently they take the vesicating agent off those parts into the mouth, and the sloughing of the mucous membrane was on an average greater (more extensive) than in horses.

What makes me more certain that the food was the cause of this trouble is that after the first real heavy frost no new cases appeared. From this it would seem very clear that the frost destroyed the germ of the fungi or other cause.

It is not only a few herds that have been troubled, but wherever cattle and horses have been pastured on this low woodland pasture they were affected, and the places where I found the most rust or fungi on the grasses and weeds were in the close vicinity of old stumps of trees that had been left to decay for years, and near them longer grasses, weeds, etc., grew, and the vegetation had not been so much disturbed. The nearer the cattle and horses were pastured to the St. Croix River or its tributary streams the more disease appeared.

Dr. C. N. Hewitt, secretary of State board of health of Minnesota, previously to my arrival at Red Wing, had sent Dr. J. H. Sandberg, an expert botanist, to the affected district. His report of fungi, etc., discovered there was handed me, and probably led me to more carefully examine the grasses than I otherwise would have done; but I had little difficulty in finding any quantity of fungi on the under parts of the leaves of weeds and grasses. The inclosed are some samples I gathered, and I am of an opinion if they are carefully examined under a powerful glass something of an interesting nature may be found.

GLANDERS.

On January 11, 1887, Mayor A. H. Hogson, of Athens, Ga., telegraphed the Department that the entire live-stock of the Athens Street Railway Company was infected with a fearful malady which had been pronounced by competent persons as glanders. He appealed for assistance in suppressing the contagion. On the day following Governor J. B. Gordon telegraphed the Commissioner as follows:

If you have authority, please dispatch a veterinary surgeon to Athens, Ga., to investigate and suggest remedy for glanders in horses.

In compliance with the request contained in these telegrams, Dr. W. H. Rose, veterinary inspector of the Bureau, was at once dispatched to Athens to investigate the cause of the outbreak and suggest such measures as might be deemed necessary for its suppression. His report, which bears date of January 20, 1887, is as follows:

When I arrived at Athens Mayor A. H. Hogson informed me that all the animals showing symptoms of the disease—7 in all—had been killed and buried on the 14th instant; that 14 had previously died—dating from the early part of November—making a total loss of 21 mules and horses up to date. The remainder of the animals (21 head) had been taken from the infected ones and subdivided into lots of 5 or 6 head each and placed in new and widely separated stables, built expressly for their use by order of the mayor. They were located in a large field near the city, and were completely isolated from all other live-stock. I found 2 of them discharging slightly from the nose. In these animals the only perceptible indication of glanders was an enlargement of the sub-maxillary glands. They were separated from those showing no symptoms of the malady and placed by themselves until more definite symptoms might appear. Owing to the many conflicting statements of citizens as to the symptoms of the animals that had died or had been killed, I found it quite difficult to determine upon the exact nature of the disease. However, I had two of the recently buried mules disinterred, and upon examination I found lesions of farcy along the course of blood-vessels and glands and a few ulcers. Both animals had enlarged sub-maxillary glands attached to the bone, extensive ulceration of septum nasi on both sides, also a number of papules. I regarded these animals as having been affected with glanders and farcy of a malignant form.

I gave Mayor Hogson such advice as the exigency of the case required, and if followed the disease will soon be stamped out.

February 9, 1887, a number of citizens of Oowala, Cherokee Nation, addressed the Department requesting an investigation of a disease among horses—something similar to glanders—which had baffled all efforts to cure it. The disease, they state, has existed in that country for a number of years, and has caused the loss of a large number of horses. At that time the inspectors of the Bureau were all engaged in the work of suppressing pleuro-pneumonia, and it was found impossible to dispatch a veterinarian to that distant locality.

Senator Joseph E. Brown, of Georgia, informed the Department in

February, 1887, that an outbreak of glanders had occurred in Greene County, Ga., among horses belonging to Mr. P. M. Mass. One animal had died and 3 others had been infected.

Mr. Charles N. Hewitt, secretary of the Minnesota State board of health, writing to the Department in April last, states that "since March 7, 1885, this board has isolated in this State over 450 horses affected or suspected of having been infected with glanders." Over 250 of this number had been killed, and at the date of his letter but 17 animals in the entire State remained in quarantine.

Mr. John T. Payne, Locust Grove, Orange County, Va., informed the Department in October last that his horses and mules were affected with farcy.

In December, 1887, Mr. John Harrison, Nash, Ellis County, Tex., wrote the Department stating that considerable excitement was existing among the people of that community over a supposed outbreak of glanders among horses. One mule had died, but the opinion was not unanimous as to the nature of the disease.

Many cases of glanders were reported to the Department during the year 1888. In May, Mr. Robert J. Vasseur, of Stroudsburgh, Pa., wrote that a contagious disease said to be glanders or farcy was prevailing among horses in that locality, that many animals had died, and several were still suffering from the malady.

Under recent date Mr. John D. Murrell, Bayou Goula, Iberville, La., writes as follows:

At the hotel stable in the village of Bayou Goula, a disease made its appearance last year which killed 2 or 3 horses. At the time it was suspected to be glanders. The proprietor tore out the troughs, cleaned up the stable, and as no other case appeared all fears were allayed. But within the past few weeks the disease has broken out again. Three more horses have died, and several others have the disease. The animals are not running at the nose, nor are there any sores on them. They lose their appetites, fall off rapidly in flesh, but drink freely. Great alarm is felt among the planters, who have large numbers of mules and horses on their plantations, varying from 25 to 75 on each place.

On July 27, Dr. F. L. Kilborne, director of the Veterinary Experiment Station, reported that he had destroyed a horse suffering with chronic glanders on the day previous. The horse was found at Sheriff-road crossing, near Benning's Station, D. C.

On September 10 Dr. Kilborne examined a horse belonging to a gentleman residing on the Falls Church road, Virginia, which was reported to be suffering with glanders. The disease had previously been diagnosed as glanders by Dr. J. E. Woodruff, who reported it. The report of the investigation and examination is given as follows by Dr. Kilborne:

History.—The horse, a bay gelding, six or eight years old, weighing about 1,200 pounds, was purchased by the present owner at a Government sale in Washington City eighteen months ago. Was apparently healthy until five weeks ago, when it was taken sick. The first observed indication of illness was a small swelling, one-half inch across, which appeared on the lateral surface of the right lower jaw just above the angle. This burst and discharged a glairy, sticky secretion; but now is nearly healed. Later a similar swelling, but larger, developed on the back part of right fore limb, below elbow. This opened about ten days ago and has been discharging since. It is still discharging a glary, viscid, more or less bloody secretion.

After the development of the swelling on the jaw, a slight, thin, glairy, sticky discharge was noticed from left nostril, and several days later a similar discharge from the right nostril. This discharge gradually increased in quantity, but of the same character, until September 5, when it became streaked with blood. Since that time it has been quite copious. There has been no cough at any time, and no nasal discharge during the past eighteen months until the present time. No ulcer-

ation was seen by Dr. Woodruff until September 3. The case had developed very rapidly during the past two weeks.

Symptoms.—Temperature $103\frac{1}{4}^{\circ}$ F. Sub-maxillary glands, each the size of a large hen's egg, nodular and firmly adherent to the skin, which was devoid of hair, although no local treatment said to have been applied. The right gland had suppurated and was discharging slightly from a small opening. In addition to the swellings above mentioned, similar swellings were noticed, one on each side of neck, and on right flank and hind limb. Only one of these—one near flank—had as yet suppurated. From each nostril there was an abundant glairy, viscid discharge, streaked with blood. Within the nasal mucosa of each side was well covered with prominent glandular ulcers, one-fourth to 1 inch across, several of them being situated nearly down to the alæ. Lungs apparently unaffected.

Diagnosis.—The diagnosis of glanders made by Dr. Woodruff was confirmed. The animal is to be shot, and the 5 remaining horses of the stables carefully watched by Dr. Woodruff.

On September 25 Dr. Kilborne was directed to examine 2 horses on Thirty-second street, West Washington, which Dr. S. S. Lippincott had reported as suffering with glanders. The following report, giving the results of his examination, was submitted by Dr. Kilborne:

Case I, History.—Light gray mare about ten years old. Has been in possession of its present owner for three or four years. Had been well and healthy during this time, except a temporary swelling of one hind limb six or eight months ago.

On the 7th instant the mare was out in a cold rain, resulting in a severe chill or cold. She had been coughing occasionally for a few days, but after the chill the cough grew rapidly worse, followed by a thin nasal discharge. Soon the inter-maxillary lymphatic glands began to enlarge and the nasal discharge to become more abundant and purulent. Ulceration of septum nasi observed for the first only a few days ago. About the 17th or 18th instant, the left fore limb and the right hind limb began to swell extensively from the foot to the body. The swelling of the fore limb had been largely reduced by bathing. The temperature during the onset of the disease was 105° F.

Symptoms.—Present temperature 100.6° F. Left fore limb and right hind limb badly swollen. The inter-maxillary lymphatic glands greatly enlarged, tumefied, and nodular, but not firmly attached. A very copious yellowish, purulent, more or less glairy, viscid discharge from both nostrils.

On each side of the septum nasi, beginning near the alæ, were numerous raised, more or less irregular patches or ulcers, one-fourth to 1 inch across, with a yellowish granular surface, in some instances surrounded by an indistinctly reddened ring.

Respiration accompanied by a snuffling sound, aggravated by movement, apparently proceeding from upper part of nose. Auscultation detected slight crepitation in both lungs. General condition reported to be much better than a few days ago.

Diagnosis.—Acute glanders.

Case II, History.—Black gelding, about eleven years old. Had been sick about two months, but used occasionally of late at light work. Has had a persistent discharge from right nostril, but none from the left. The right inter-maxillary lymphatic gland had been greatly enlarged, but was now reduced in size. Three to four weeks ago a small swelling, the size of a butternut, appeared over right nostril, 2 or 3 inches above the false nostril. This was reduced by a blister, but on the blistered surface appeared several small unhealthy sores or ulcers which are now nearly or quite healed. Limbs were swollen some time ago. No cough observed at any time. General condition has been improving for two or three weeks.

Symptoms.—Temperature 99.6° F. Right inter-maxillary lymphatic gland enlarged, tumefied, nodular, but not attached. From the right nostril there was a thick, glairy, yellowish discharge, drying on the nostril so as to form a well-marked ring all around the nasal opening. No discharge from left nostril.

Nasal mucosa of a dull color, especially in the right side. On the right side of septum nasi, near the alæ, were three or four nodules or tubercles the size of small hemp-seed. Well up on the septum the speculum revealed a slightly raised deep red patch, half an inch across, showing evidence of disintegration or granulation at the center. Lungs normal.

Diagnosis.—Chronic glanders, but opinion reserved at that time.

Contrary to the expressed wishes of the owner, I removed the gray mare to the Veterinary Experiment Station, with the understanding that she would not be killed until after 9 the next morning, in order to give them an opportunity to have the mare re-examined. This course was taken because the parties were not satisfied

with my diagnosis and because the attending veterinarian, Dr. A. F. McMaster, had given an opinion only the day before that the animal was not glandered.

The following morning (September 22), just before 9 o'clock, the owner, in company with Dr. McMaster, the attending veterinarian, Dr. C. B. Robinson, of the District government, and Mr. Mann, of the People's Mutual Live Stock Insurance Company, visited the station to re-examine the animal. Dr. McMaster still gave a diagnosis of catarrhal ozoena. Dr. Robinson gave a qualified diagnosis of glanders. Later in the day Drs. Robinson and McMaster visited the stables and examined the black gelding, Case II. After this examination Dr. Robinson suspecting that both horses had glanders advised the parties to send the black horse to the station, which they did the following Monday morning, the 24th instant. Monday afternoon Dr. Robinson, in company with Dr. C. L. Moulton, visited the station and re-examined both animals. They agreed in confirming my diagnosis of both cases.

This morning (September 25) I killed and examined both animals in the presence of Drs. McMaster, Robinson, Moulton, and Lippencott.

Autopsy, Case I, gray mare.—The whole nasal septum on both sides nearly covered with the glanderous patches above described. The ulcers were more granular, the discharge more glairy-viscid, and the pituitary membrane darker colored than when I first examined them. The adjacent mucosa lining the sinuses and covering the turbinated bones, thickened, one continuous sheet of ulceration, dotted with nodular or whitish points one to three lines across. The examination carried no further.

The autopsy satisfactorily confirmed the diagnosis of acute glanders with all present, Dr. McMaster reluctantly admitting the correctness of the diagnosis.

Autopsy Case II, black gelding.—In addition to the lesions described in the examination, the mucosa on the ventral half of the upper third of the right side of the septum nasi presented an unhealthy, raw surface, from which the epithelium was removed and the surface found dotted with numerous small erosions and nodules. The adjacent mucosa of the septum also showed isolated erosions and cicatrices. The mucosa covering a considerable portion of the turbinated bones similarly affected. In the right frontal sinuses the mucosa thickened, of an ulcerate character, near the orifice to the nasal cavity being greatly thickened, and the periosteum beneath destroyed, with slight necrosis of the bone. Left nasal chamber normal. A few nodules scattered throughout each lung.

The autopsy confirmed the diagnosis of chronic glanders to the satisfaction of Drs. Moulton, Robinson, Lippencott, and myself. But Dr. McMaster being of opinion that the horse was not glandered, to him the lesions showed no evidence of glanders, but rather of a catarrhal trouble, the present discharge being due to necrosis of bone beneath the diseased mucosa.

On October 13 Dr. Kilborne visited stables at the foot of Four-and-a-half street, Washington, D. C., for the purpose of inspecting 2 horses which had been reported as probably glandered by the agent of the Humane Society. Both animals were found suffering with glanders, but were quarantined until the 15th of the month, when they were shot.

Again, on October 29, Dr. Kilborne examined and had shot 2 horses afflicted with glanders on F street northwest, Washington, D. C. The following report gives the results of Dr. Kilborne's examination:

Case No. 1.—Bay gelding about ten or twelve years old. Temperature 105° F. Greatly emaciated. A copious glairy, purulent discharge from right nostril, adherent in quantities and drying all around the nostril. Only slight discharge from left nostril. Right surface of septum nasi entirely covered (or far as visible) with glanderous ulceration. No ulceration seen in left. Sub-maxillary lymphatic glands only slightly enlarged, free. No farcy buds noticed.

Case No. 2.—Brown gelding, also greatly emaciated. Temperature 103° F. Hind limbs stocking. Sub-maxillary glands and skin same as case 1. Discharge and ulceration of both nostrils same as right nostril of case 1.

No autopsy in either case.

Both horses were being treated for catarrhal inflammation or nasal gleet by one William C. Kimpton, a so-called veterinary surgeon, who bled both animals from the neck only yesterday.

On same day (October 29) Dr. Kilborne examined a horse at the foot of South Capitol street, Washington, D. C. The animal was found suffering with farcy, and was shot.

DISEASES OF GAME BIRDS.

Hon. Joseph B. Battelle, collector of customs, Cleveland, Ohio, writing under date of February 15, 1887, speaks as follows of the results of his efforts to domesticate game birds, and the diseases to which they are subject:

Herewith you will find inclosed report of a *post-mortem* on the ruffed grouse (or "pheasants," as they are called in the South), made by Dr. Grinnell, of New York. Permit me to say that since receipt of your letter I have read your reports for 1880, '81, '82, '83, and I find many points in common between the diseases diagnosed in them and the report of Dr. Grinnell. (Of course I speak from a non-professional standpoint.) My interest in this matter grows out of a series of experiments I have been conducting for the past three years looking to the domestication and breeding in captivity of some of our game birds, notably the quail and ruffed grouse, particularly the latter, which are declared by all the authorities to be incapable of domestication. These birds appear to be peculiarly susceptible to diseases of the "cholera" type, and my experiments, otherwise very satisfactory, have been sadly interrupted by the loss of six or seven fine grouse through this cause.

Dr. Grinnell was of the opinion that the birds above alluded to died of avian tuberculosis. He gives the following as the results of his *post-mortem* examinations:

On December 23 last I received from Mr. J. B. Battelle, of Toledo, Ohio, the body of a fine specimen of a male ruffed grouse (*Bonasa umbellus*) with the following history: The bird came to him from Wisconsin, and had been in confinement six weeks, and up to within thirty-six hours of its death it seemed in fair health. Mr. B. had three of these birds confined in one inclosure, 4 feet wide by 28 feet long, the coop having been occupied two months previously by some other birds. He stated that it had been disinfected and the ground raked over; that the birds were fed from a wooden trough and watered from a tin vessel, and that the place was kept as clean as circumstances would permit. The two remaining birds (hens) were at this time apparently perfectly well. *Post-mortem* examination showed the following condition: Bird well nourished, weighing 18 ounces. The organs showing acute disease were the lower part of the small intestines near the cæca, the liver, and probably the spleen, though the *post-mortem* changes were so advanced that it was difficult to determine this. The gut was tied together in this region by peritoneal adhesions, which, however, were readily stripped apart. From the outside could be seen numbers of yellowish points or nodules, which were hard and resistant to pressure. Upon slitting the gut the nodules seemed to be located in the sub-mucous coat. A very few scattered nodules were found beneath the peritoneal covering of the liver. Under the microscope these bodies proved to be tubercles with the characteristic cheesy broken-down center, surrounded by the giant, or aggregated, white cells, and in and around these the colonies of bacilli. The diagnosis of tuberculous peritonitis was made.

I wrote to Mr. Battelle, stating my diagnosis and belief that the two hen birds would shortly succumb, and requested that they be sent to me as soon as possible after death. On December 30 I received the second bird, a hen. She had likewise died after a twenty-four hours' sickness. Examination showed the same appearances in general, but the tuberculous matter had not developed into true tubercles, but lay attached to the mucous and submucous coats in the same region, exactly resembling what Sutton describes as occurring in very acute cases, "irregular, craggy-looking masses of a yellowish white color." This bird was not in as good a condition as the first. The gut was matted, and adhesions were present. The third bird died on January 7, with the same symptoms, but unfortunately was not sent to me. These three specimens represented a wide geographical distribution. The cock came from Wisconsin; the hens, one from Michigan and one from New York.

The conclusions from these facts seem to be that some birds are more susceptible to the tubercle poison than others. These grouse had every attention given them but undoubtedly became infected from the soil in their cages. The raking up of the ground may have contributed to this. Quail appear to be less susceptible for they live and thrive in captivity when the hygienic surroundings are decidedly bad. At the same time I think that further investigation will show that the mortality among captive quail is due principally to this disease. The question whether, as Nocard holds, birds of the barn-yard become infected from the sputum of tuberculous patients, or man from eating the flesh of diseased birds, is still *sub judice*. It has been

proved that tuberculosis has occurred from drinking the milk of tuberculous cows. It may be suggested that the floors of aviaries, whether of soil or sand, and the cage itself, as far as practicable, be disinfected semi-weekly with Platt's chlorides, copperas, or some other disinfectant. This can readily be done with a small sprinkler. The subject is of great interest and importance.

DISEASE AMONG ARKANSAS CATTLE.

In April, 1887, the Department was informed that a disease was prevailing among a herd of cows belonging to Mr. A. Emonson, of Carlisle, Ark., which was supposed to be contagious pleuro-pneumonia. Dr. N. H. Paaren was directed to proceed to the locality, make an investigation as to the nature and cause of the disease, and report the results to the Department. His report, bearing date of April 30, is as follows:

Mr. A. Emonson, of Carlisle, Ark., has a ranch of about 1,600 acres of mostly grazing land, on level prairie, bounded by woodland east and west, upon which are kept about 200 head of native cattle. To this place were brought from Duquoin, Ill., on the 2d of March, this year, 12 head of registered, imported Holstein cows. They are said to have been in poor condition of flesh when they arrived at Carlisle. Here they were kept by themselves, well housed and well fed, so stated by Mr. Emonson. On or about the 16th of March, 2 of these cows got sick with what was supposed to be pneumonia. One of these died on the 20th and the other on the 21st of March. On the 28th of March 2 more died, and a week thereafter 3 died in one day. Four days thereafter another death occurred.

On my arrival at the ranch, on the 15th of April, I saw only the remaining 4 head of Holstein cows. Two of these have remained healthy since their arrival, and were in fair condition of flesh. The 2 others were said to have been very sick, but are now recovering, and in very poor flesh. I found respiration in one of the latter to be 30 and in the other 36, pulse 76 and 90, and the temperature $102\frac{1}{2}^{\circ}$ F. and 103° F., respectively. On account of the lungs having been supposed to be affected, these two cows had recently been extensively and severely blistered with spirits of ammonia and croton oil, on both sides; in fact, to such an extent that the resulting tenderness and swelling almost completely rendered both percussion and auscultation impossible except on a narrow strip along the upper part of the thorax, at which place I could detect nothing abnormal. On being turned out on a grass lot by themselves, these two recovering cows moved around in a dragging, emaciated manner, picking at the grass with apparently very little relish. One of them made a single dry and husky cough; the dung was soft and of a peculiar dark or black color, and the urine was clear but scanty.

The symptoms presented during the activity of their ailment, I am informed, were in all cases nearly similar. Breathing was much accelerated, pulse from 70 to 90, ears drooping, head held low, indifference to surroundings, suspension of rumination, loss of appetite, and occasional coughing. Three of the cows that died aborted while sick.

In regard to the cause or causes of this disease, I could elicit nothing whatever from the owner and others in position to know something about it. It would be but mere guessing if I were to attempt to form an opinion from an imperfect description of symptoms, or from the present appearance of the two slowly recovering cows, with the additional obstacle to a thorough physical examination, caused by the very severe blistering above stated. I learned that some of the cows that had died were opened and examined; but the statements by persons who were present do not agree. In some of the animals the spleen was said to be abnormally large, of a dark blue color externally, and the cut surface dark brown and soft; the stomach full of food, said not to be very dry or impacted; one or both lungs slightly congested. Liver normal. The animals were sick three to six days before dying.

If more time had elapsed before the animals began to get sick, it would appear that they might have died from splenic or so-called Texas fever. The statement made as to the appearance of the spleen made me first suppose that this might be the case; otherwise that there must have been some local cause or influence in operation; but my inquiries in this direction were fruitless, and it appeared to me that the facts in the case as to the cause of the disease were studiously withheld from me. I concluded that there was no contagious disease on this range, after looking over all the cattle kept here.

One week subsequently, or on the 23d of April, while on a train a short distance

north from Texarkana, on my way to Chicago from an official inspection at Madisonville, Tex., I saw Mr. A. Emonson in the smoking-car. On my inquiry as to the condition of his cattle, he said that statements made to me, while on his place on the previous week, were not correct. That neither the spleen, liver, nor any of the organs of the abdominal cavity were found diseased. That the lungs alone, and in all cases, either one or both, were extensively inflamed and discolored, and that he believed that the 12 Holstein cows sent to him from Duquoin, Ill., were really affected with pleuro-pneumonia. That this had prompted him to resort to a continued treatment with fever medicines, and first to use ordinary blisters on the chest, and as these latter did not act as desired, the more severe applications of spirits of ammonia and croton oil were resorted to. While on my first visit to his place, I was informed that there had been no coughing among the diseased cattle; I was now told that they had all coughed more or less, especially mornings and evenings, or at milking time. I knew that I had given the 2 remaining convalescing ones a very careful examination, and doubted very much whether I should have made such a mistake as not to recognize the existence of pleuro-pneumonia, even in recovering cases. Still, the fact that a thorough physical examination was impossible on account of the effects of the severe and extensive blisterings, together with Mr. Emonson's present statements, made me doubtful, and as the train neared Little Rock station I concluded to change cars, go to Carlisle, and re-examine the 4 remaining Holstein cows.

I found the 2 cows that had remained healthy since their arrival still healthy and in good condition. In the 2 convalescing cows respiration was 20 and 26, the pulse 70 and 80, and the temperature was increased to 104° F. and 105° F. respectively. The facility for percussion and auscultation was worse now than before, because the cuticle over the whole of the blistered surfaces of both cows was beginning to separate, being cracked, bulging, and dry, while the underlying surface was infiltrated with pus and presented long furrows of raw surface, which made the animals shrink at the least touch. The crackling noise of the dried and shriveled portions of cuticle caused by attempts at laying the ear against the chest, made all efforts at auscultation futile. I heard these 2 cows cough; it was a repressed, dry, husky cough, but not exactly the one peculiar to pleuro-pneumonia.

The 12 head of Holstein cows were brought here with a view of starting more extensive breeding of this class of stock in the Southern States; and Mr. H. Horn, of Duquoin, Ill., who sent them here, retained a half interest in them. They were valued at \$375 each; and as already 8 of the lot had died, Mr. Emonson was unwilling to entertain any proposal, even for pay, to slaughter the worse appearing one of the 2 convalescing cases.

Taking into account the above conflicting statements of *post-mortem* appearances, the obstacles to a thorough physical examination, and the withholding from me of all information as to the real cause of the disease and deaths (as will be shown further on in this report), I concluded not to make any special or definite diagnosis before I could have an opportunity to examine into the condition of the cattle kept by Mr. Horn, at Duquoin, Ill., and possibly from him obtain information that might throw some light on the cause of the losses at Carlisle, Ark. This opportunity was kindly given me by your order of April 25, based upon my dispatch giving a brief statement of existing conditions at Carlisle.

Calling on Mr. Henry Horn at Duquoin, Ill., I was informed by him that he owned 2 Holstein bulls, 11 Holstein cows, and a number of yearlings and calves of this breed. Also, 5 Hereford bulls, 20 Hereford cows, and a number of yearlings and calves of this breed. Also, about 60 head of grades and natives, cows, yearlings, and calves. These were kept on four farms, located in different directions from Duquoin; and from among these were shipped the 12 head of Holstein cows to Carlisle, Ark.

After a careful examination of all the above cattle, I am satisfied that no communicable or contagious disease exists among them; and upon inquiry of Mr. Horn, as well as of a number of disinterested persons in this locality, who are in position to know if any disease has existed among his cattle, I am informed that, with the exception of some small tumors on the necks of a few of them, and which tumors are of a scrofulous nature and common among cattle in many localities, no disease or losses from disease have occurred among Mr. Horn's cattle during the last past twelve months. I have found the cattle here all in ordinary good flesh and condition.

Now, therefore, I conclude that the losses by disease and death which have occurred among the Holstein cattle, taken to Carlisle, Ark., from Duquoin, Ill., in the beginning of March last, were due to local causes, as I suggested while at Carlisle, but the exact nature of which I was unable to determine while there, because of reasons already stated. My opinion is confirmed by statements made to me by Mr.

Horn, while I was at his place, and by letters written to Mr. Horn by reliable parties in Arkansas, who, at the request of Mr. Horn called on the premises of Mr. Emonson, attended to the sick cattle, and made *post-mortem* examinations there.

Mr. Horn says that he went to Carlisle on learning of the first appearance of disease there; that he was then informed that these cows were fed largely on whole cotton-seed and hay; that the dung passed by the cows was of a peculiar black color, and that he at once insisted that they should be given no more cotton-seed, but instead thereof have ground corn, oats, and bran; that a veterinary surgeon should be employed, and that such a one by the name of Smith, from Memphis, Tenn., came there, prescribed treatment, and advised discontinuance of cotton-seed feeding, but feared the change of feeding was rather late, as more cows were sick, or dying. The said veterinary surgeon was also present and made *post-mortem* examination of the 2 cows that died first, and he told Mr. Horn that he found the lungs and liver congested, and also impaction of the manifold stomach.

As the said Mr. Smith could not remain, nor return again to Carlisle, Mr. Horn had an experienced stockman, named D. A. Phipp, of Stuttgart, Ark., go to Carlisle and attend to the increasing number of sick Holstein cows. Although Mr. Emonson had promised Mr. Horn that no more cotton-seed should be fed to these cows, Mr. Phipp, in a letter to Mr. Horn, dated Stuttgart, Ark., April 9, 1887, says that he "found cotton-seed mixed with bran and salt before the cattle, and at once forbid feeding any more cotton-seed. Found 6 of the cows affected in the lungs and purging; blistered them heavily and gave fever medicines. Opened 5 dead cows and found them as expected."

Dr. Buerkle, a physician of Stuttgart, Ark., who was also present at Carlisle, and together with Mr. Phipp performed the *post-mortem* examinations, writes in a letter to Mr. Horn, dated Stuttgart, Ark., April 13, 1887: "I am satisfied that the disease of the cows was caused by mismanagement and feeding on cotton-seed, the only thing they were fed outside of hay. I examined the dead cows, and found a general inflammation of all the vital organs. In two cases we found, besides pleuro-pneumonia, inflammation of the stomachs, bowels, liver, etc. In another dead cow I found pneumonia and inflammation of other vital organs." In the same letter, Dr. Buerkle further says: "There is a great mistake made by the public in regard to the word 'pleuro-pneumonia.' Most of the people think that the aforesaid sickness is just the same as contagious lung plague, or what we Germans call *Lungenseuche*. The reason I called the cause of death of these cows pleuro-pneumonia, in connection with general inflammation was, that both lungs were inflamed, and the membrane investing or inclosing the lungs was also inflamed; that is what we would term pleuro-pneumonia; but the rest of the important organs of the body, being in the same inflamed condition, satisfied me that the Emonson Mining and Milling Company are to blame for the loss."

It is scarcely possible that Mr. Emonson and the persons in his employ did not know of the existence of all of the above stated conditions of the cattle, and the main cause thereof. The range is located only 6 miles from Carlisle, and I am informed that Mr. Emonson visited the place frequently, in fact, that he directs all operations there. Why all this information was withheld from me, after my repeated solicitations as to possible causes and conditions existing before my arrival, may, perhaps, be conjectured as due to the fact that Mr. Emonson had not paid his half interest in these cattle, and, in fact, since the death of 8 of the number he has returned, unsigned, to Mr. Horn, the two notes, respectively giving one and two years' time for payment. Still, Mr. Emonson, and the people at Carlisle, Ark., affect surprise and disappointment because I could not or would not then and there state some cause of the trouble, and give a name to the ailment of the cows—pleuro-pneumonia being seemingly no objection.

FATAL DISEASE AMONG SWINE.

In January, 1887, Dr. N. H. Paaren, an inspector of the Bureau of Animal Industry, was directed to proceed to Cerro Gordo and adjoining counties in northern Iowa and determine, if possible, the nature of a very fatal disease prevailing among hogs in that locality. After as thorough an investigation as could be made during that season of the year, he reported as follows to the Department, under date of February 2:

The disease from which the hogs have been affected in northern Iowa, has prevailed during the fall and winter of 1885-'86, and the fall and winter of 1886-'87,

mainly in the four counties of Worth, Mitchell, Cerro Gordo, and Floyd, especially along the Shellrock River.

The farms I visited were all in Cerro Gordo County, about 10 miles southeast from Mason City. The first place was Gus. Seidel's farm, where no hogs were found, the last of a herd of about 50 head having died last October. The nearest place to this farm where sick hogs were said to be, was about half a mile distant and owned by A. R. Stilson. Found no signs of disease among his hogs; but during the previous month he had lost 25 head of various ages, all under a year old. Found one dead hog behind a straw stack. It had died about thirty-six hours previously, and was frozen stiff. It was about eight months old. The bottles sent to you, numbered 1, 2, and 3, contained portions of left and right lung, and the spleen, all of which were as hard as a rock when they were removed from the animal and put into the bottles.

Mr. Stilson believed that this would be the last hog he would lose, as the disease seemed to be disappearing all around. He said the animals would first appear dumpish and lose their appetite, but remained very thirsty. There was not much coughing. Soon more or less diarrhea would appear, and they would die after about three days' illness. Last winter he lost about the same number of swine with similar symptoms prevailing. During the spring and summer of 1886 there was no such disease prevailing in this locality. The animals were well kept and cared for, were not crowded, ran in the straw-yard, were well housed, and there were no wet grounds around, as the country around here is high and undulating. The hogs on this place had access to drinking water which was running from a spring beginning on the farm, at the edge of the pasture, along which it runs a short distance and then leaves this man's land. The spring comes direct from the rock. Never lost hogs before the winter of 1885-'86. Had bought no hogs at all for one year before disease appeared, and then (two years ago) bought only a boar from Owen Dennison's farm, north of Mason City, who Stilson says has lost no hogs from disease. Stilson feeds his hogs on corn exclusively, except in summer, when they subsist on pasture alone, after which they get green corn until fattened.

About the first place where hogs were lost in this neighborhood was on the farm of the before-mentioned Gus. Seidel, distant one-half to three-fourths of a mile from the farm of A. R. Stilson. Seidel is said by some to have lost hogs right along from last spring until October, when the last one of an original herd of about 50 head died. The next neighbor of Seidel is F. Bailey, and the hogs of the former could have access to or come in contact with those of the latter. Thus F. Bailey lost during the fall of 1886, 7 or 8 hogs; but has had no more losses since the month of December last. Bailey's farm lies between Seidel's and Stilson's; and Stilson thinks his hogs may have been in contact with Bailey's hogs. From Stilson the disease went to his next neighbor, T. P. Stanberry's hogs, thence to the latter's neighbor, Rial Barney. Stanberry lost about 14 hogs this winter, and says that he has had no disease or further losses lately, or since he began feeding his hogs on oats. The hogs kept in this neighborhood are mainly Poland-China and red hogs, mixed breeding.

After careful inquiry I could not learn of any place where there were any sick hogs; so I have seen none but dead ones.

There is a soap factory at Mason City, to which dead hogs are gathered from all sources; and the contents of the bottles sent to you, and numbered successively after the first three ones sent, were from hogs opened by me at the said soap factory, which is owned by J. E. Tandro. A hard frost having prevailed, the carcasses were all well preserved and stiff. In this factory I counted some 70 dead hogs piled up. In none of these could I detect any discoloration of the skin. Here were hogs of all ages, from about three months to over a year old, and some piggy ones amongst them. In one part of this place I saw piled up the entrails of more than 100 hogs. In none of these, after careful examination, could I find signs of inflammation or ulceration of the intestinal or digestive organs; nothing beyond congestion. The kidneys seemed all right. In some, one lung seemed more affected than its mate; but in all, the lungs and spleen appeared like the specimens sent to you. The liver seemed more or less congested or inflamed in the whole lot examined.

The owner of the soap factory keeps a number of hogs running around his premises. He says he feeds them on nothing but the offal or entrails from the dead hogs collected, except what they can pick up in the neighborhood. He also says that he never lost any of his hogs by this kind of feeding. It seems there is a prejudice in the locality against using soap manufactured from hogs that have died from hog cholera; and he probably keeps these hogs thus for the purpose of convincing people that since they do not die from this feeding material, or running around the carcasses of the diseased hogs, these collected hogs could not have died from hog cholera. But it may be doubtful whether any of the said hogs die, since they could easily be disposed of on the same premises without the knowledge of outsiders.

"LEECHING" OF HORSES AND CATTLE.

Dr. J. C. Neal, Archer, Fla., writing under date of July 13, 1887, gives the following description and history of a disease known as "Leeching," to which horses and cattle in that locality are subject:

I send you to-day a specimen of diseased tissue taken from the lower jaw of a horse. This represents a singular disease peculiar, I think, to this section, very common and very fatal to horses and mules. The common name is "Leeching."

In the central part of this State are hundreds of ponds, usually with a belt of grassy prairie around, and a hummock, rocky, and with hard-wood trees growing densely. Nearly all of these lakes are shallow, with water-grass, water-lilies, etc., growing on the margins. Into these grassy places the horses, mules, and cows that are "turned out" for the summer on the prairie go often, till they can barely keep their feet, and feed all day in the water. After a varying exposure to the influence, or whatever it may be called, of the "pond," a slight lump or elevation of the skin may be found on some part of the body that has been submerged. To the touch it will feel as if a grain of shot were lodged beneath the skin. In eight or ten days the skin sloughs off centrally over this hard spot, and discovers a bloody, bruised-like surface, exuding serum and blood—no pus. This rapidly grows in size till in a few weeks there is a raw surface from 4 inches to 1 foot square. This drops blood and serum, but no pus. An examination will show, usually, a mass of yellow, gritty growth, coral-like in shape, imbedded in a mass of bruised, bloody tissue, dark in color and the edges roughened, elevated above the skin, and the skin decaying at the outside of the ulcer. The leech invades any tissue, but seems most common on the legs, abdomen, and sides. Occasionally it is found in the head. The invaded tissues decay slowly, and apparently without pain. I have seen hoofs cut off, the abdomen opened, the eyes eaten out, the teeth destroyed, etc.

This specimen was from the mouth of a four-year-old gelding, and when first found the animal was walking around with open mouth, tongue out, and dripping blood. At the request of the owner I had the animal thrown and made an examination. I found an ulcer occupying all the lower jaw from the front teeth to the roots of the tongue. This was about 2 inches thick—an open, offensive ulcer, with points of the gritty leech protruding, giving it a roughened look and feel. The ulcer extended over the edge of the lower teeth, hindering mastication. There was a small bunch at the angle of the jaw—outside—the skin not broken, also one in the face near the right eye. I cut to the bone and found the leech imbedded in that, and also in the tongue, and pronounced the case incurable.

The treatment is to cut off all diseased tissue and scar with hot iron or nitric acid, or nitric acid followed by carbolic acid. Still, if the disease invades the abdomen, the hoof, or the mouth, there is no known remedy. During the last twelve years I have devoted some time to the study of this unique trouble, and can give you some facts regarding it.

It does not occur in cypress ponds. It happens that in ponds with cypress at one end only, there will be leeching only at the other end.

All ponds do not leech. Often, of two ponds within half a mile of each other, one only will leech stock.

All horses do not leech, only those of good blood. The Cuban and Texan ponies as a rule are exempt.

It is not contagious. A sucking pony may be badly leeches and the dam will lick the ulcer, and yet not be affected. Dogs, chickens, and cats will greedily eat the cut-out fragments of a leech and not take the disease, nor do those who cut out the spot ever have any trouble.

The mule is rarely affected, cows still more rarely.

The period of incubation is from one to eight days. One attack does not protect against another. Some horses leech every year.

Upon examination of the specimens forwarded by Dr. Neal the sections showed considerable cell infiltration, which was probably due to inflammatory changes. There were also a few centers which seemed to be in a condition of necrosis, as they failed to stain. Owing to the manner in which the specimens had been taken out it was difficult to identify what particular tissues the pieces represented. In some the mucous membrane showed quite distinctly, as did also a salivary gland. The examination failed to reveal the nature of the disease.

"MALADIE DE COIT," OR VENEREAL DISEASE OF HORSES.

In the early part of July, 1887, Dr. James Law, inspector of the Bureau of Animal Industry, attended a meeting of owners and breeders of horses at Clinton, Ill., which was called for the purpose of devising means for the suppression and eradication of *maladie de coit* (venereal disease of horses), which was prevailing to an alarming extent among equine animals in De Witt and adjoining counties in that State. While at this point he made quite a thorough investigation as to the character of this outbreak and the extent to which the disease prevails among horses in the locality above indicated, the results of which he embodies in the following report:

I left Chicago on the night of July 6, and reached Bloomington, McLean County, next morning, where I saw in the stables of Dr. Williams 3 Norman draught stallions, the property of Harold & Culbertson, of Wapella, De Witt County, and in the advanced stages of the venereal disease. These, in company with 16 others, were imported by their present owners in 1884.

I next went to Wapella and drove out to Mr. Carle's, where I found a gray stallion of the same importation in a still more advanced stage of the disease, showing, beside the local lesions, considerable hebitude and paraplegia.

From there I proceeded to the farm of James Somerville, of Wapella, where I saw a mare which had been bred to the Carle horse in 1886, but seemed well till bred again April, 1887, to the black stallion of Mr. Fischer, Clinton, which she is charged with having infected. This mare is at present badly affected. She had already the characteristic white spots around the vulva before being bred to the Fischer horse, showing that she had already suffered from the specific disease.

I next visited another farm to see a mare alleged to have recovered. She showed in a marked condition the characteristic white patches around the vulva, and in the trot manifested an imperfect co-ordination of movement of the muscles of the hind limbs. Yet we found her doing good work in a mower, and in the absence of a very careful examination she would not have been at all suspected.

From this point I drove to Clinton, where, in the hands of Dr. Morin, I found 2 more Harold & Culbertson stallions under treatment, and both badly diseased.

In the village of Clinton I also saw 2 stallions of Mr. Fischer, one a brown horse, suffered in 1884 from a disease of the generative organs which incapacitated him for breeding for an entire year, but he has now apparently recovered. This horse bears on the left side of the neck at the root of the mane a D brand (Dourin?) which he is said to have had when imported from France. The second Fischer horse is black, excessively fat, with some swelling of the sheath and of the orifice of the urethra, and to a slight extent along the abdominal veins, but is full of life and energy. This is the horse that is supposed to have been infected by the Somerville mare referred to above.

Diagnosis.—I have omitted symptoms in referring to the above, and shall only now enumerate such as identify the disease with the *maladie de coit*, or venereal disease of horses, of the Old World.

In the mildest cases in stallions there is only some little swelling of the sheath or scrotum, or of the testicles (primarily of the posterior pointed end). If more extended, swellings appear along the lines of the lymphatics accompanying the abdominal or saphena veins, on one or both sides, and often appearing intermittently. Accompanying these are the minute extravasations or exudations in the skin which result in destruction of the pigmentary layer and the formation of white spots one-fourth to one-half an inch in diameter, but at times becoming confluent and forming considerable patches. In other cases the sheath remains enormously swollen and the penis pendulous from 4 to 18 inches, and in the worst cases apparently incapable of retraction. A scurfy, dry, and even chapped condition of the penis is common, and a puffy swelling of the circular ring near the base of its free or protracted portion is especially so. I saw no especial swelling of the glands as described in books. The testicles are often greatly swollen, rounded, and pendent, measuring as much as 18 inches and 2 feet in circumference. Along the course of the lymphatics in different parts of the skin and subcutaneous tissues are somewhat flattened and round or elliptical exudations or neoplasms, which occasionally burst and discharge a purulent matter. This supuration sometimes takes place in the sheath or scrotum and with the discharge there comes a material though temporary amelioration of the symptoms as testified by Mr. Culbertson, a close and intelligent observer. Swelling of the submaxillary lymphatics occurs sooner or later, and in the advanced

stages the nasal mucosa are extensively ulcerated and discharges a very tenacious muco-purulent product.

In all cases, except the very mildest, imperfect assimilation and nervous atony are well marked. Drowsiness may be an early symptom, and spiritlessness and dejection are very common, the two most persistent and controlling desires being appetite and the sexual passion. The Carle horse, wasted to a skeleton and with his penis flaccid and pendulous, and retracted only an inch or two when struck, stands persistently in the corner nearest to some mares in another lot, forgetful of hunger or thirst, yet will eat and drink inordinately when urged by his attendant. The nervous atony is seen especially in the waddling, uncertain gait of the hind limbs, the uncertainty being especially marked on turning, the wounds from interfering on the fetlocks and pasterns, and the wasting of the muscles of the hinder extremities. As a rule the hind legs swell considerably in bad cases.

In the mare the first symptoms are swelling, usually at first on one side of the lips of the vulva and in the upper half, later the lower half and even the clitoris are implicated, the vulvar mucosa is congested, and minute spots of extravasation or exudation appear on this and on the adjacent skin, resulting in the white spots already referred to. There is, besides, an increased desire for the male, not continuous, but, according to Mr. Culbertson, lasting three or four days at the first "heat," and eight or ten days at the second. He also contradicts the allegations of an abundant muco-purulent discharge (whether in male or female), and I saw no indication of any profuse muco-purulent flow from the generative passages.

As the disease advances in the mare the swellings extend from the vulva mainly along the lymphatics of the perineum, the mammae, the abdomen, the thighs, the quarters, and elsewhere. These and the local circumscribed swellings are as in the horse. This similarity extends to the inter-maxillary, nasal, muscular, assimilatory, and nervous symptoms.

Abortions are frequent, or puny ill-developed foals come to maturity, and some show the distinct manifestations of the acute disease in local swellings, sores, and fatal marasmus. In other cases even the diseased mares bring fine vigorous foals to maturity.

History.—A complete history of the outbreak is not yet forthcoming, yet the following gives the main facts as I have been able to learn them:

Before 1884 a Clydesdale stallion was brought from some part farther south to Vernon, Tex., and sometime later died of a malady believed to have been the venereal disease. While at Vernon he had been turned into a corral with a number of native mares. How it fared with them does not appear, but as deaths are common on the open ranges Mr. Culbertson opines that a few dead ponies would lead to no remark.

From another party, whose name I did not obtain, I learned that Mr. Lemon, the owner of the Vernon ranch where the Clydesdale horse died, brought a lot of mares from that ranch to his place near Clinton, Ill., in 1884, that they infected a stallion there, and a number suffered.

Mr. Harold, of Harold & Culbertson, had a Texas ranch 60 miles south of the Lemon ranch, so that there was ample opportunity for infected mares from the latter joining the herds of the Harold ranch and communicating infection. In April, 1884, Messrs. Harold & Culbertson, of Wapella, Ill., imported 230 Texas horses, among which were 160 to 170 mares from the Harold (Texas) ranch, and the latter were served by Utopia and other Norman stallions belonging to an importation of 19 made in January, 1884. No disease was noticed that year in either horses or mares on the farm, so that any manifestation must have been very slight. In 1884 these imported stallions served in addition 114 outside mares, of which none were known to have become affected. In this year 3 of the imported stallions were sold to go to Eureka, Peoria, and Nebraska, respectively, and no ill report comes from them.

In 1885 these stallions served 197 mares, of which 4 at least (2 Texan and 2 home mares) showed the disease in the fall. Mr. Culbertson can not say in which it first appeared. The same year one of these stallions died from an unknown cause; 2 sold to Foley & Seniff, of Wapella, showed the disease later and are now ill, and 1 sold to a party in Bloomington, and later to W. R. Carle, also showed the disease and is now in its most advanced stages. Nine mares served this year by the Foley & Seniff horses are now dead.

In 1886 one of the imported stallions died of the venereal disease, and a second died probably from the same cause. Two stallions sold to go to California are supposed to have continued sound. Harold & Culbertson lost 8 mares from the disease and had others ill, and of 242 services outside his stud some mares are known to have died of the affection, and 3 surviving diseased ones have been seen. The great majority have not been examined. Of 60 mares served this year by the Foley & Seniff horses,

8 are dead, 10 affected, and 9 sold. Of mares served this year by the Carle horse, 2 have died and others are ill.

To complete this history I must add the hearsay evidence from Dr. Morin, an irregular veterinarian at Clinton, a man named Daniels, and Mr. Moore, who owned the brown stallion branded D, and sold him to Mr. Fischer, to the effect that that horse not only suffered in 1884, and was incapacitated for service for an entire year, but that he also infected a number of mares before he was withdrawn from service.

Probable source of the disease.—So far as the above testimony goes, it seems to exclude the idea of the importation of infection with the 19 stallions of Harold & Culbertson introduced in 1884. First, no untoward results could be found in mares served by them in 1884; second, those of their number that were sold to distant points in that year appear to have continued sound; third, one of them retained by Harold & Culbertson, but used out of the district, is still sound; fourth, the disease was shown in Harold & Culbertson mares as early as in the horses—late in 1885. Since that date it has been propagated extensively to horses and mares alike.

The suspicion attachable to the Texas mares is somewhat vague. The death of the Lemon horse on the Texas ranch, and the alleged disease of Texas mares on the Lemon farm in Illinois, are suggestive. It has not been shown, however, that the Lemon stud in Illinois had not been interbred with the Moore horse (now Mr. Fischer's) which is testified to have suffered in the same year, or with mares bred to that horse.

The strongest suspicion is apparently to be fixed on the imported Moore (Fischer) horse, branded D. Report says this horse came from France in 1883; served and infected mares in 1884, suffered from a disease of the generative organs in the same year, but has now apparently recovered. This being accepted, it is easy to conceive of the infection on the Lemon farm in 1884 from this source, and of that on the Harold & Culbertson farm in the autumn of 1885.

If this could be implicitly relied on it would only be necessary to root out the infection here in Illinois and to trace every horse sold from the infected locality since 1884.

As regards the locality, the State has agreed to provide inspectors, and a large local committee, with a member in each town, has been intrusted to quarantine and brand all exposed animals. Time must show how effectively this will work.

The horses and mares that have been sent out of the State would require to be followed by the National Government if they are to be attended to at all.

It may be well also for this Bureau to send an inspector to the Lemon ranch at Vernon, Tex., to make sure that the disease is not being spread there and in the vicinity.

If it is judged desirable to investigate the microbial source of the disease there is abundant opportunity at Clinton and Wapella. By sacrificing one of the victims the exudates in the testicles, sheath, and other tissues could be received into sterilized tubes and forwarded to Washington.

I would suggest further the inoculation of foals, geldings, and barren mares with the products of the diseased mucous membranes, of the generative organs, of the nose, and of the interstitial exudate. This would determine at once the susceptibility of the animal apart from generative excitement, and the virulence or harmlessness of the diseased products of other organs than the generative ones.

A PREVENTIVE AND CURE FOR HOG CHOLERA.

Mr. S. A. R. Beach, of Whitlock, Montgomery County, Ind., gives the following preventive and cure for hog cholera:

In September, 1887, I had 178 hogs and pigs weighing from 300 pounds down to sucking pigs. They were running in a meadow and pasture, having a creek with gravel bottom running through it. I had been feeding corn in the ear, and had commenced to feed a light ration of green corn, cut and hauled out each day. No other hogs were near or had come in contact with mine. About this time I found that one or two of the small shoats would not eat. In a day or two I saw that the "jig was up"—that something had to be done or I would have to follow the lead of others, ship out for sale all I could and lose the balance. But I took what I eventually found a better course. I went to a druggist, and after consultation with him agreed upon the following recipe, which is good: Take 5 pounds sulphur, 2 pounds copperas, 1 pound black antimony, one-half pound saltpeter, and 1 pound common salt. Mix and pulverize well, then mix a like amount of wood ashes and feed in oats or mill feed. This amount should be given in 3 feeds, once or twice a day, for some time, to 100 hogs. Remove the hogs to a new feeding place and give them fresh beds as often as possible. They should have running water to drink. Every sick hog should at once be placed in a hospital, away from the well ones, and completely isolated. The sucking pigs of

the herd will not live, so the sooner they are disposed of the better. In this attack I lost all but 6 of my sucking pigs, 8 of my shoats, and 2 large hogs. However, by giving this medicine, and by feeding lightly for awhile and changing often, I got through with 52 fine 300-pound hogs, which I sold in November, and 55 nice 200-pound animals, which I sold in March following. I have 56 brood sows and stock hogs left, which were all among the first herd attacked. I regard the result of this medicine as most excellent. Many of my neighbors have tried it, and each and every one pronounce it both a preventive and cure. With proper sanitary care I believe it will prove a great benefit, and I gladly give it to the public.

DESTRUCTION OF ANIMALS BY HEEL FLY.

In the month of February, 1887, Mr. S. O. Cotton, of Coleman, Tex., informed the Department that he had forwarded a copy of a newspaper containing an article which he had written in regard to the "heel fly," an insect which he stated was very destructive to cattle in that locality during the early spring months. He asked for information on the subject, and if no preventive measures against the attack of these insects were known, or remedies for the wounds inflicted, he requested that a competent person be detailed to make an investigation. In reply to a letter from the Chief of the Bureau of Animal Industry, asking for additional information, Mr. Cotton writes as follows under date of March 29, 1887:

I regret my inability to comply with your request, as the "heel-fly" time is over for this season. I think, however, you are laboring under a misapprehension in supposing that this so-called heel fly develops under the skin of the heel, and is different from that which develops in the back of cattle. I suppose it is called heel fly because it attacks the heel, and cattle run into water to escape it; but from my observation I find that the fly more frequently attacks cattle under the belly and flanks, and about the tail, than on the heel. "Devil fly" would be a more proper name for it, for it is certainly the most devilish insect that I know of. I have never seen the insect attack the back of a cow, but have seen it escape from the back just as it had come out of the hole in the skin of the cow. Nor have I ever found the larvæ elsewhere than in the back near the loin region. Hence I conclude that the maggot works its way from the belly, the flank, the tail, the heel, or wherever it is deposited by the fly, under the skin and up to the animal's back, where it develops into the so-called "grub" or "wolf," bores a hole up through the cow's skin and comes out a full-fledged, devilish fly, ready to commence business. How the maggot manages to work its way under the skin and up to the back of the animal is one of the many things I don't know and would like to find out.

On April 11, 1888, Mr. Cotton wrote that he had forwarded to the Department dried specimens of the fly, and also three larvæ preserved in alcohol. In this letter he says:

I have made no new discoveries regarding this insect since my letter of a year ago, but am still convinced of the theory I then gave. It is without doubt the greatest pest that afflicts the brute creation here. My losses in cattle the past winter, particularly during the month of March, were very heavy, and I attribute fully half the deaths to this abominable fly. They worried the cattle every bright, warm day from February to the 5th of April this year. During this time the cattle were growing weaker day by day, and running into water and bog-holes to escape the fly, would stand there until they were chilled, and then would get down and be unable to rise again.

ACTINOMYCOSIS.

Dr. R. Martin, a member of the Wisconsin State board of health, writing from Milwaukee under date of November 21, 1887, says:

We have had a number of cattle from the West brought to our city suffering from a maxillary tumor which always discharges a large amount of offensive pus. Several have had a tumor under and invading the eye, the discharge in these cases being partly through the nostril. The animals are all very thin and show the

effects of the drain on the system, and have all been condemned as unfit for human food, and the carcasses sent out to the fertilizing establishment. While in attendance at the A. P. H. A., at Memphis, last week, Dr. ———, of Chicago, informed me that the flesh of such animals was not a dangerous article of food, as the disease is caused by a coarse grass which has worked its way into the flesh, and as soon as it is opened and the foreign body removed the recovery is rapid. He said further that on a ranch in which he is interested they kill such animals for their own use rather than one that has a better market value. Can you give me information as to the nature and name of the disease and your opinion as to whether I was justified in my order to condemn the material for food? Has your Department published anything on this subject, and if not what work can I secure that will give me a general knowledge of the same?

Dr. Salmon, Chief of the Bureau, replied to this letter as follows:

I would say that, from the lesions you give, the cattle were probably affected with the disease known as *Actinomyces*. Formerly this affection of the jaw was described under the name of *Osteosarcoma*, *Spina ventosa*, Fibro-plastic degeneration of the bone, and similar titles, it being regarded as due to a tubercular or cancerous diathesis of the system, or to local injury. (See Williams' Prin. and Prac. Vet. Surg., Edin., 1879, p. 199; also J. W. Hill, Bovine Med. and Surg., London, 1882, p. 138; Clater's Cattle Doctor, p. 62; Steel's Diseases of the Ox, p. 423.)

Actinomyces is regarded as an infectious disease, caused by the microscopic fungus *Actinomyces*, and is most frequently seen in bovine animals, though it occurs in other domestic animals and in man. But very little has been written upon the subject in English. The only articles I can refer you to are Vet. Jour., London, Vol. XVI, p. 1, by Fleming; also a small work by Fleming entitled "*Actinomyces*," published in 1883 (for sale by W. R. Jenkins, New York), and an article by Professor Axe in the Veterinarian, London, Vol. LV, p. 811. This Department has published no report on the subject.

It is well to examine the tongue and the viscera of the animal for the yellowish nodules of the diseased tissue (which are supposed to contain the germ of the disease), and to prevent such parts at least from being used for food. The Chicago health authorities, I understood, were condemning the carcasses of all animals affected with this disease a year or two ago, but I am unable to say whether or not they still continue to do so. Where the local tumors are of considerable size and suppurating I believe it sound policy to prohibit the sale of the flesh for food.

PARASITIC BRONCHITIS AMONG CALVES.

1 An outbreak of parasitic bronchitis occurred among a herd of calves belonging to Dr. E. A. Hering, Cross Keys, Rockingham County, Va., in October, 1887. In a communication to the Department, dated on the 16th of that month, he says:

I have a herd of calves, from four to six months old, suffering severely with parasitic bronchitis, a disease sometimes called "husk," "hoose," etc. The herd contains thirty-odd calves. These calves were exposed to the long spell of wet weather which prevailed here during nearly all the month of September. They were grazed on meadow land, which, of course, was quite wet; but the grazing was good and plentiful. They were also fed once a day a moderate ration of wheat bran mixed with cotton-seed meal. I noticed a few weeks ago that they were not looking well, and ordered an increase of meal. About two weeks ago a calf was reported sick. The great prostration, and loud and difficult breathing rendered it necessary to haul it to the stable. I found it dead next morning. No *post-mortem* was made. It was then observed that other animals commenced coughing, and rapidly the outbreak became general. I supposed they had taken bad colds from the previous wet weather, which had been followed by cold nights and heavy frosts. Their condition became so serious that I had Dr. John A. Myers, a young veterinary surgeon of Harrisonburgh, see them. He gave it as his opinion that the calves were suffering with parasitic bronchitis. A calf dying on Friday night we made a *post-mortem* examination and found the doctor's diagnosis perfectly correct.

These miserable parasites, called, I believe, *Strongylus micrurus*, were to be found by the thousands from the larynx all through the trachea and down the bronchial tubes to the small ramifications of the same. Perhaps the greater number were found at the bifurcation of the trachea. These worms were from 2 to 3 inches long—some longer—and as thick as a large sewing-thread. They are white.

Another calf died last night, and an examination revealed the same state of affairs, except the lung was more engorged and the parasites had penetrated deeper into the lung. I have a half dozen or more calves now very weak, and they look as though they may not survive the week; others much afflicted but still strong.

I write to ascertain the best mode of treatment. I have John A. Steel's work, but it is not satisfactory. Fumigations are recommended, but I can hardly see how any good can be derived from their use. I think the worm can stand of this about as much as the calf. Two days ago I commenced drenching each calf, morning and evening, with an ounce of spirits of turpentine and an ounce of linseed oil, the latter to prevent strangling and the former as an anthelmintic, knowing it will be absorbed by the blood and much of it thrown off by the lungs, thus giving the worms a wave of the odor of turpentine at every expiration. I stable at night and graze on upland through the day.

I have been a practicing physician for more than thirty years, and when I think of the windpipe of man or beast filled up with thousands of worms it seems to me to be a most formidable trouble. I believe it would be more managable in the human than in the brute.

In answer to Dr. Hering's request for information regarding this disease, he was referred to the Second Annual Report of the Bureau of Animal Industry, which contains an article of considerable length on the treatment of this malady. In the course of his reply Dr. Salmon said:

Fumigations of sulphur have generally been considered efficacious, although in some cases they fail. The most certain treatment I know of is by tracheal injection. I have known of animals being cured by this treatment when they have resisted all other remedies. The formula used is: Oil of turpentine, 2 drachms; carbolic acid, 2 drops; chloroform, one-half drachm. This has been recommended to be given in one dose by injecting it with a large hypodermic syringe directly into the trachea. If I were treating by this method I should not give more than half of this dose the first time, and see how the animals supported it. A second or third injection might then be made, increasing the dose.

TRANSMISSION BY MEDIATE CONTAGION.

The following well-authenticated cases of the transmission of pleuro-pneumonia by mediate contagion were given by Dr. W. H. Wray, in May, 1887, while performing the duties of chief inspector for Maryland:

The following instances show that contagious pleuro-pneumonia can be conveyed, without doubt, by mediate contagion, and that as a preventive measure disinfection of all buildings and surroundings should be thoroughly done:

Case No. 1.—A butcher, who had possession of the wagon used for the conveyance of animals affected with pleuro-pneumonia, left it in the yard where his 2 cows were kept. About one month after the wagon had been left there, 1 of the cows was taken with acute pleuro-pneumonia. She was slaughtered, and on *post-mortem* examination her left lung was found completely hepatized, well marbled in appearance, and about 1 gallon of serum was found in the thoracic cavity. A few weeks later the other cow was affected and slaughtered, and the same lesions were found in the right lung. These animals were bought by the owner three and four years ago respectively, and had never been away from the place, except to the bull, and for this purpose the last time was fully a year ago. There was no communication with the animals brought on the place for slaughter, neither did any of the butchers or men connected with the slaughter-house come in contact with them. The only thing the two animals came in contact with that had been exposed to pleuro-pneumonia was the wagon referred to.

Case No. 2.—A herd of 34 head of cattle on the Hookstown road was slaughtered on January 5, 1887. A new barn had been built about 50 yards from the old one, and filled with new animals about three weeks after. Word was left with the owner that the old stable should be thoroughly disinfected and cleaned before putting any more animals in it, and he was requested to let me know when he was ready and I would attend to the matter for him. This he neglected to do, but whitewashed and sprinkled chloride of lime and carbolic acid around the stable himself, thinking this would be sufficient. His new stable being full, and needing

more cows, he purchased 8 head about the latter part of March, and put them in the old stable. On May 7, 28 head, all new purchases, were inspected by Dr. Martenet and all found in good health. On May 18, the owner called at the office and stated that he was afraid that he had 2 cows affected with contagious pleuro-pneumonia. I inspected his herd of 30 head on May 20, and found his suspicions well grounded, as both animals were affected with acute pleuro-pneumonia in its worst form. One had a temperature of 106° F., and complete dullness and loss of respiratory murmur on left side, hard, dry cough, and a grunt at every inspiration. The other cow had a temperature of 104½° F., with crepitation well marked over whole surface of right lung. On *post-mortem* examination both cows showed all the characteristic lesions of acute pleuro-pneumonia. The new herd was inspected by Dr. Dimond previous to going to this place, and all were found in a healthy condition. There was no way of their coming in contact with the contagion except through the old barn.

HYDROPHOBIA IN A COW.

Mr. W. W. Curd, New Providence, Calloway County, Ky., writing under date of July 2, 1887, gives the following account of a cow that was attacked and died of hydrophobia:

At the request of several farmers of this county I send you the following description of a disease caused by the bite of a rabid dog. Recently there have been killed in this county several dogs that were supposed by several of our leading physicians to be suffering with hydrophobia. A number of cows have died in my neighborhood, all affected in the same way with the exception of one, which vomited often. The last case I visited daily during her illness. She showed the first symptoms on Friday morning and died on the Tuesday night following. She seemed to be mad from the outset until her death. She would chase the family hogs, sheep, and geese, and once caught a goose, killed and ate it. At times she would attempt to graze, but I do not think she bit off any grass. She would come up to the cowpen and eat a few ears of corn, but would allow most of it to fall out of her mouth. If any one attempted to approach her she would gnaw the rails and bellow. She would not chase, nor did she seem to pay any attention to her nine months' old calf. No unusual thirst was apparent—no dread of water; slabbered profusely at the beginning of her illness but scantily toward the end. An anxious expression or wild look of the eyes was always apparent. She held her head very high while lowing, which she did incessantly both day and night. She seemed greatly distressed and in a most piteous condition. There was some tremor about the head and neck the evening before she died. At night she was always moving about with her head higher than common, and stepping higher than usual, like a blind horse, though her sight seemed good.

A young lady in this vicinity was bitten by one of these rabid dogs and died of a disease which several of our leading physicians pronounced hydrophobia.

ANTHRAX AND CHARBON.

In April, 1887, Messrs. John B. Mead and Edgar N. Bissell, State cattle commissioners of Vermont, notified the Department that anthrax prevailed among a number of herds of cattle in that State. In the course of their communication they say:

A malignant form of anthrax has broken out in several herds of cattle in Bennington County in this State. Quite a number of animals have died during the past winter, but as soon as the fact of its existence was made known to us we at once proceeded to isolate the infected herds, and take such measures as in our power to prevent its further spread; and we hope, indeed, to be able to stamp it out altogether. But so great is the danger and so uncertain the hope of a speedy extermination that we respectfully ask of you to lend us the arm of the Federal Government in the prosecution of so important a work. The disease was brought here last fall in quite a large herd of calves purchased in New York. They were driven from Albany to Bennington County, and were scattered somewhat among the farmers of that county.

Mr. Charles N. Eley, of Smith's Point, Chambers County, Tex., writing under date of June 6, 1887, gives the following account of an outbreak of charbon among horses and cattle in that locality:

There is prevailing at present in this county a fearful mortality among cattle, horses, and sheep. Mr. James T. White has lost in the last two weeks 600 head of cattle; James Jackson 17 head of horses and 300 head of cattle. Other stock-men have lost largely. I have lost 2 milch cows and have one horse sick now. The disease is commonly called charbon, but the symptoms are variable. Some have high fever and are stiff in their joints. In horses it is first observed as a small swelling on the side or stomach. Very few recover. Treatment does not seem to do much good, for about as many get well without as with it. The better the blood of the stock the more fatal the disease seems.

Quite an extensive outbreak of a disease supposed to be anthrax was reported as prevailing among cattle on the farm of Mr. Hastings, located about 3 miles from Northborough, Mass., on the line of the Old Colony Railway. Dr. W. H. Rose, a veterinary inspector of the Bureau, was directed to make an investigation as to the nature and cause of the disease and report the results to the Department. In his report, bearing date of April 19 last, he says:

About four weeks ago Mr. William Hastings purchased 16 cows from a man named Wheeler. The latter purchased them from William Scullans, a cow dealer of Brighton. Since they came into Mr. Hastings's possession they have all been affected with diarrhea, but with the exception of 2 animals they have all made a fair recovery. Ten days ago 1 of the 3 died. To-day I killed a second one. On dissection the mucous membrane of the entire intestinal tract showed intense inflammation. I found the same appearances in the bladder. The spleen and liver were very soft. The serous coverings of the intestines were also intensely inflamed and congested. The blood was almost a walnut color, and soon coagulated when it came in contact with the air. It then soon became lighter in color. Prior to death a crackling sound could be heard along the dorsal and lumbar regions when the skin was rubbed with the hand. I found a small piece of the lower and posterior portion of the left lung hepatized. The hepatized portion was only about 4 inches across each way and 2 inches thick. In making a section I found the lining one-eighth inch in diameter and uniform in width throughout the greater part of the hepatization, with bright red lobular spaces. A clear colored serum was visible over the fresh-made section. I pronounced the disease anthrax, and regarded the lung lesions as due to septic poisoning. I learned that the hay fed to these animals was cut from meadow lands submerged in water. A dam had to be cut in order to let off the surface water before the grass could be mowed. The land lies between hills, is very low, and never dry except in seasons of extreme drought. Under the floor in which the cattle were confined I found a manure pit filled to a depth of 3 feet with a semi-liquid manure. These cattle were brought originally from New York.

In August, 1887, the Department was requested to send a veterinary inspector to Ellenville, Ulster County, N. Y., for the purpose of determining the nature of a disease prevailing among cattle in that county. Dr. C. B. Michener was directed to make the investigation, the results of which are given in the following report:

I returned late last night from Ellenville, N. Y., where I had gone by your instructions to investigate an outbreak of disease among cattle. The animals that have been attacked belonged to Messrs. George Hill and Seth Green, who reside about 14 to 16 miles from Ellenville. The pastures upon which these cattle grazed were high, but quite soft and marshy. They are entirely removed from any line of traffic. No cattle are purchased from outside, as the farmers raise all their stock. There have been no deaths for the past two or three weeks. I carefully examined the remaining herds, but could find no evidence of disease. Upon inquiry I learned that, as a rule, the fattest and best young animals were the ones generally attacked. These died in from twenty-four hours to three or four days. Mr. George Hill lost 5 head—2 cows and 3 yearlings. Mr. Seth Green lost 2 young animals. I learned of single cases of death as occurring in herds at various surrounding points, but attached no particu-

lar importance to these, and did not visit any herds except those belonging to Messrs. Hill and Green. The symptoms and *post-mortem* appearances detailed to me, taken in connection with the season, character of soil, etc., all prove conclusively that death was due to a form of anthrax fever. There were no signs of contagious pleuro-pneumonia, and, in fact, from the history and location of the herds, no possibility of the existence of this disease. I so informed the owners and local members of the health board. I gave them full instructions as to the treatment necessary in case of further trouble, and also as to preventive measures that should be adopted.

BLACK LEG.

A number of outbreaks of black leg occurred in widely separated localities during the year 1887. On January 11, Dr. Charles N. Hewitt, Red Wing, Minn., a member of the State board of health, wrote that a farmer near that place had lost 4 calves during the past three weeks showing the following symptoms and *post-mortem* appearances: Lameness in one or more legs, speedily followed by inability to rise when down; no fever; some dyspnoea, and death from apparent exhaustion in twenty-four hours. But 4 have had extreme swelling of one limb. Effusion of blood in cellular tissue in limbs swollen. Lungs sound, except slight congestion and some bronchial effusion; nothing serious; abdominal viscera sound so far as I was able to discover.

Hon. John T. Caine, of Utah, incloses to the Department a letter bearing date of Adamsville, Beaver County, Utah, January 31, 1887, stating that he had recently lost 6 head of yearling calves by a disease known as black leg. The symptoms were swelling on side of jaw, right shoulder, and left thigh. The swollen parts felt pulpy, and sounded as though containing blood; lameness in legs affected; no appetite. Death occurs in about twelve hours after first symptoms are observed.

Mr. Thomas Memmott, writing from Scipio, Millard County, Utah, under date of February 15, 1887, says that for the past few weeks young horned animals in that county have suffered and died of a disease known as black leg.

Mr. G. W. Zents, Tionesta, Forest County, Pa., writing under date of April 16, 1887, states that cattle in that county are suffering with a peculiar and fatal disease. The disease first manifests itself by the animal showing lameness in one leg. The breathing is heavy, and death occurs from four to six hours after lameness is first observed. Just before death the afflicted animals begin to swell or bloat. On removing the skin from the lame leg after death the flesh is found to be black and blood clotted. This blackness extends into the body. If lameness begins in a front leg death occurs sooner than when it begins in a hind limb. No one seems to know what the disease is. Cattle that appear all right in the evening are found dead in the morning.

Under date of July 29, 1887, Mr. Louis A. Johnson, of Rochester, Foran County, Ohio, informs the Department that he has lost a number of spring calves by a disease which kills the animals very suddenly. Of the symptoms he says that the animals are taken suddenly sick; will not eat; stand around without any apparent pain, and die in less than a day. There are blood-shot places under the hide, principally on the legs and under the chops.

TUBERCULOSIS.

In January, 1887, Dr. W. H. Rose, an inspector of the Bureau, examined a herd of cattle belonging to Messrs. Smith & Hefflebower, in the vicinity of Weverton, Washington County, Md. There were 7 cows, 6 calves, and 1 bull in the herd. One of the younger cows had been wasting away for eighteen months past, and presented a typical case of tuberculosis. Mr. Hefflebower stated that he had lost 5 cows during the past ten years with this disease. On the ribs and sternum of the carcass of 1 that had died two weeks previous to Inspector Rose's visit, and which the buzzards had not yet devoured, he found large masses of tubercles.

In April, 1887, Dr. H. W. Rowland, an inspector of the Bureau, examined a herd of cattle belonging to Mr. Charles W. Saunders, living near Eldred, N. J. His herd was composed of 3 cows and 2 steers. He had lost a cow about two weeks previous to Dr. Rowland's visit. Two of the remaining cows were coughing; they were very weak and greatly emaciated. Their temperature was 103° and 102½° F., respectively. Dr. Rowland killed 1 of the animals, and upon *post-mortem* examination found abundant evidence of tuberculosis. He was informed by Mr. Saunders that a good many cattle had died in that locality with symptoms similar to those existing among the animals of his own herd.

On July 13, 1887, Inspectors Trumbower and Walrath examined a herd of cattle belonging to Mr. Julius Jordan, residing near West River, Anne Arundel County, Md. The herd was supposed to be affected with contagious pleuro-pneumonia, but a physical examination revealed well-marked lesions of tuberculosis. To satisfy the owner as to the nature of the disease, an ox, which had been in declining health for some months, and a cow, which was in good order but gave evidence of lung trouble, were slaughtered for *post-mortem* examination. The autopsy revealed extensive tubercular masses in the lungs and bronchial glands of the ox. In the lungs of the cow were found small masses of tuberculous deposits. The intestinal and mesenteric glands exhibited general tuberculosis. Out of 13 head of cattle remaining 8 were found suffering with the disease. Two years ago Mr. Jordan purchased 24 head of cattle at the Baltimore stockyards. Out of this number he lost 12 head within one year. Last year he lost 3 animals and this spring 2.

In May, 1887, Dr. W. H. Rose was directed to visit Chesterfield, N. H., and examine a cow which was reported to be suffering with a severe lung disease which it was feared might prove to be pleuro-pneumonia. The following brief report gives the result of his examination:

I yesterday examined the cow belonging to Mrs. Carrie B. Stockwell, of Chesterfield, N. H. She was affected with tuberculosis, accompanied with leucorrhœa. She is a Jersey-bred cow, and was purchased by Mrs. Stockwell from Mr. E. Safford in January last. Mr. Safford purchased the animal of Mr. Johnson, of Keene, N. H., about a year ago. Mr. Safford says the cow had a cough at the time of the purchase. She seemed to improve after the weather became warm, and continued in fair condition until the cold and windy weather of last winter set in. Mr. Johnson purchased the cow of Mr. G. B. Williams, of Walpole, N. H., who owns a herd of Jersey cattle.

PREVENTIVE INOCULATION FOR PLEURO-PNEUMONIA.

The following letter, addressed to Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, by Dr. P. R. Gordon, chief inspector of stock for Queensland, Australia, gives the results of the writer's experiments in inoculation as a preventive of contagious pleuro-pneumonia or lung plague of cattle:

OFFICE OF CHIEF INSPECTOR OF STOCK,
Brisbane, Queensland, March 18, 1887.

SIR: I have the honor to acknowledge, with thanks, the receipt of a copy of your interesting and elaborate report No. 2, of the Bureau of Animal Industry, for the year 1885.

I may be permitted to offer a few remarks on that portion of your interesting report on pleuro-pneumonia which refers more particularly, at page 138 *et seq.*, to the results of inoculation as a preventive in Australia, and in so doing I speak from an official and practical experience on the subject of twenty-five years, nineteen of which have been spent in my present office as chief inspector of live-stock for the colony of Queensland.

I do not take exception to the comments on the Blue Book and published returns of New South Wales of 1875, because these returns were very incomplete, and at that time opinions were divided on the subject, a considerable minority of cattle-owners having been strongly under the influence of Professor Simmons' opinion, which was largely circulated throughout the colonies. With an additional twelve years' experience of the subject, however, I am safe in asserting that if the cattle-owners of Australia of to-day were appealed to opinions would be all but unanimous in favor of the practice. Such, at least, would be the verdict of my own colony, and no one is in a better position than I am to judge of this matter. Inoculation had necessarily to be carried out by non-professional men on most of the herds, and these possessed little knowledge as to the selection of proper virus. The cattle were wild, few of them having ever been handled, except when being branded as calves, and it will readily be understood that the operation was performed—in crush-pens—in a very primitive manner. The difficulty in mustering wild herds rendered it impossible that every animal in a herd could be inoculated. On many herds the practice was not adopted at all, and as there were no restrictions on the traveling of infected and diseased stock, the disease was kept constantly alive in the colonies.

You are probably unaware that the whole of the cattle in the Australian continent, numbering over seven and a half millions, may be said to compose one huge herd, intermixing from one end of the colony to another, so that when a single case of infection is introduced at one extreme end—as was the case in 1858—it is only a matter of time when it will be conveyed to the other extreme end of the Australian continent. By the time the disease has spent itself in the south, it is in active operation in the herds of the north. As there is a constant traffic in store cattle from the northern herds of Queensland to the southern colonies, infection is again introduced to the southern herds, where it readily finds a nidus in the cattle that have been born since the previous attack, and in this manner a constant wave of the disease is kept oscillating between the extreme north and south of the continent.

There is much force in your argument that the reports and observations on the results of inoculation in Australia have been largely those of unscientific men, and as such are not entitled to the same respect as those of qualified veterinary surgeons. At the same time I may be permitted to remark that there are many duly qualified veterinary surgeons in these colonies, who have had extensive experience in the matter, and I think I am correct in saying they are unanimously in favor of the practice. The government veterinarians of the whole group of Australian colonies are decidedly favorable to it.

But I think you will concede that on such a question (particularly when the opinions of scientific men are fairly divided on it) the experiences and observations of practical men may be allowed some weight, and I therefore take the liberty of bringing under your notice the following facts:

(1) In this colony we have an act providing for the registration of all brands and ear marks in cattle, administered by me. Under that act a special ear mark is set apart as an "inoculation ear mark" to distinguish cattle that have been inoculated, and its use is not permitted for any other purpose, and it is an undoubted fact that the losses among cattle bearing that ear mark are very few indeed, not exceeding 1 per cent. (including those which die from the result of the operation), whilst the losses amongst uninoculated average from 5 and 10 to 15 and 20 per cent.

(2) Returns of all stock in the colony are annually rendered to me, and these confirm the statements of the owners that when the wave of infection is gradually passing across the colony, those herds that have been inoculated lose few if any by deaths, whilst the losses in conterminous herds of non-inoculated cattle are very heavy.

(3) Very serious losses occur amongst uninoculated store cattle while being traveled from non-infected districts of northern Queensland to the southern colonies, while traveling through infected centers; the journey in many instances extends over a period of six months. During the present season some of the losses have exceeded 26 per cent. in mobs of 1,000 head. Whereas, when the cattle have been inoculated prior to starting on their journey the losses have been *nil*, even when traveled over a main stock-traveling route strewn with carcasses of cattle that have succumbed to the disease. This is so well known to professional drovers that they will not undertake to drive uninoculated cattle on the usual terms of a fixed bonus per head on all cattle delivered at their destination.

(4) In the southern colonies of New South Wales and Victoria many runs are used exclusively for fattening store cattle, and their owners are solely dependent on the herds of Queensland for their annual supplies of store cattle. Guided by long experience these graziers readily pay from 10 to 15 shillings more per head for inoculated than for uninoculated cattle, and consequently the "inoculation ear mark" has acquired a commercial value.

(5) About twenty years ago pleuro-pneumonia was introduced into New Zealand by some cattle shipped from Newcastle, New South Wales, and infected a portion of the cattle on the principal island of that colony. That outbreak was completely stamped out by inoculation, and no case of the disease has since been known in any portion of New Zealand. This fact appears in the official records of proceedings of the conference of chief inspectors and veterinarians of all the colonies, held at Sydney in September last.

(6) Towards the end of last year a pedigree-stud herd in this colony was inoculated at the request of the owner (under my directions as to selection of virus and mode of operation), and before any of the cattle on the run had been infected. On the same run there is a general mixed herd of cattle, none of which were inoculated. Pleuro has since passed through the run with the result that whilst the deaths in the general herd have been heavy the stud herd has maintained a complete immunity from the disease.

Since 1858, when the disease was first introduced into Australia, up to 1880, although it was constantly present in some portions of the Australian colonies, the losses from it gradually decreased until at the last-named date they did not exceed 5 per cent. on the whole of the cattle on the continent. In most districts $\frac{1}{2}$ per cent. more than covered the loss. During that period inoculation was practiced generally throughout all the colonies, and was resorted to in all districts in which the disease had obtained a footing. The losses were so very trifling that the stock-owners believed that since the disease had become acclimated (as it were) it had assumed such a mild form that the casualties from it would become in time almost imperceptible. In 1881 commenced an unprecedented drought, which continued with very great severity up to June of last year. In consequence of this, and of the mildness of the attacks of pleuro, inoculation was completely suspended from 1880 until very recently. Since the breaking up of the drought pleuro has appeared with very great virulence all over the colonies, and the losses have been very much heavier than at any previous period during which inoculation was practiced.

I am aware that where cattle are housed, or are artificially fed and thoroughly under control, as in England, and as they are (as I understand) in the older settled States of America, the disease can best be controlled by the pole-ax; but such a mode of dealing with it would be an utter impossibility in Queensland, where the four and a half millions of cattle roam over the natural pasturage in a state of nature.

In our dairy herds, on the coast water-shed, near to cities and towns, inoculation was, until within the last few years, regularly practiced, and not a single case of pleuro has been reported to me, or any member of my staff, from any of these dairies, for fifteen years, until three weeks ago, when the disease broke out in a dairy herd, 8 miles from this city, in consequence of contact with a few infected cattle purchased in the public sale yards, and none of the inoculated cattle have yet shown the disease, although in contact with the infection. It is possible, however, that this latter statement may be premature, and that the disease may affect the whole herd.

From my long experience and careful observation of the effects of inoculation I am convinced that were some effectual means discovered of preserving the virus of pleuro-pneumonia, or of cultivating it apart from the living subject (as has been

done in the case of the bacillus of anthrax), so that a supply can be at all times available and the inoculation of all calves at the time of branding made compulsory for a few years, pleuro-pneumonia would disappear from the Australian continent.

I have the honor to be, sir, your most obedient servant,

P. R. GORDON,
Chief Inspector of Stock.

MALIGNANT CATARRH AMONG CATTLE.

In July, 1887, Dr. James Law was called to Steele County, Minn., to make an investigation of a malady which had prevailed in a herd of cattle belonging to Mr. Fred. Ahrens, of that county, for something like a year previous. Subsequently Dr. Law reported the results of his investigations as follows:

I have just returned from Havana, Steele County, Minn., where I made an investigation of a malady which has prevailed in the herd of Fred. Ahrens, of that place, for the past year. I learned that Mr. Ahrens had lost 11 cows and 13 yearlings and calves out of a herd which still numbers 50 head. The disease had taken but 2 or 3 animals at a time, and sometimes at long intervals, but once developed it advanced with great rapidity and carried off its victim in three or four days. It had been confined to no particular season, though there had been no cases from November 18, 1886, to March 15, 1887. Among old cattle it had been confined to cows, though among calves and yearlings it showed no predilection for a given sex. Five cows had died from spring to November, 1886; in March, 1887, 5 more cows died, and in July 2 more cows fell ill, of which 1 died the day before my arrival.

The food had been so varied that nothing seemed justly chargeable on that, while the water taken from an artesian well was exceptionally good. The cattle-yards were on rising ground and well drained, and the barns in good condition.

The nature of the soil seemed to be the one thing inimical to health. The pasture was a 160-acre lot having a large swale in it, as is so frequent in different parts of Minnesota. In another pasture adjoining the barns, and in which I found the last surviving subject of the disease (a cow), the greater part of the surface was covered with high, dense tufts or hummocks, indicating its habitually wet character. Finally just below the yards and receiving their drainage was a large, stagnant, offensive pond, which the owner is now engaged in filling up.

Mr. Ahrens has owned the place for a number of years and lost no cattle until 1886. The 160-acre pasture he rented, and prior to his renting it others had done so without losing cattle turned on to it.

Symptoms.—These are described to me, and as seen in the one surviving case, agreed in all essential particulars, and may therefore be stated in general terms. The attack comes on suddenly with a violent trembling or nervous shuddering, which often occurs in paroxysms. The secretion of milk promptly dries up; appetite is completely lost, and the coat stares, though to a variable extent at different times. The breathing becomes hurried and anxious, and all the visible mucous membranes are congested and their nutrition largely impaired. The eyes are of a slightly yellowish-red color, and water abundantly, saturating the sides of the face; the muzzle dries, cracks, and has its cuticle detached in shreds; the tongue parts with its epithelium when it attempts to withdraw it; the vulva, of a dark-red, granular appearance, discharges a muco-purulent fluid; the rectum is in a similar condition and stains the feces with blood and blood-clots, and also the thermometer used to take the temperature. The victim shows nervous disorder, by dullness, acute nervousness, or loss of muscular control, so that in the advanced stages it sways and staggers, or when down is utterly unable to rise. Death usually occurs in convulsions with much struggling. Temperature in the advanced stages, 101.5° F.

In the case which I saw one horn came off in the hand of a man who assisted in drawing a cow out of the ditch. The matrix of the horn was of a deep red color, and from it blood oozed, but the loose connection indicated the impaired nutrition of the structure.

Necropsy.—Ecchymosis on the mucous membrane of the mouth, nose, larynx, bladder, and rectum; also on the omentum and mesentery. The sublumbar, mesenteric, and omental glands were congested. No marked ecchymosis was observed on the first three stomachs, though the ingesta adhered with great tenacity to about 2 inches of the folds of the third stomach near their attached border. The mucous membrane of the fourth stomach was of a deep, dark red, but not much thickened nor softened. The mucosa of the duodenum was also congested. The remainder of the small intestines, and the large with the exception of the rectum, seemed nat-

ural; liver firm and natural in color; spleen under 2 pounds and also natural in color, consistency, and appearance. The lungs were normal in the subject I saw, though in animals dying in March, 1887, there was found chronic bronchitis, the air tubes being filled with a tenacious muco-purulent product (an accidental complication). The interior of the corniferous frontal process, where the horn had been torn off, showed some congestion of the mucous membrane. The blood coagulated on exposure to the air, but with less than the usual consistency.

Diagnosis.—The surroundings of the herd, the symptoms, and *post-mortem* lesions tend to but one diagnosis—the so-called malignant catarrh of cattle.

Recommendations.—As this affection is usually associated with a poison generated in connection with damp or water-logged soils, Mr. Ahrens was instructed to drain and fill the offensive pond at his farm buildings, and to either fence in the swale in his pasture, or, better, remove the herd to a new pasture on a gravelly, well-drained soil. It was further advised to give the cattle daily a dose of sulphur and sulphate of iron, and to carefully watch the excretions and on the first sign of costiveness to administer a laxative.

If these recommendations are attended to I apprehend little future danger to the herd of Mr. Ahren, while his neighbors are only likely to suffer if they are exposed on the same ground.



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